WITRYNA

OBRONY PRAC DOKTORSKICH

Dr Daria Lisewska – *absolwentka Wydziału Chemii Uniwersytetu Mikołaja Kopernika (UMK) w Toruniu, specjalizacja chemia polimerów. W 2024 r. ukończyła studia doktorskie w ramach Doktoratu Wdrożeniowego realizowanego we współpracy Wydziału Chemii UMK w Toruniu z Siecią Badawczą Łukasiewicz – Instytut Materiałów Polimerowych (Ł-IMPIB). Obecnie jest zatrudniona w Ł-IMPIB na stanowisku starszego specjalisty. Prowadzi badania z zakresu mikrobiologii, w tym prace dotyczące biodegradacji i oceny aktywności biobójczej i grzybostatycznej materiałów polimerowych. Zajmuje się również przetwórstwem oraz oceną właściwości fizykomechanicznych tworzyw polimerowych.*

Tytuł pracy doktorskiej: ***Wpływ warunków wytłaczania polimerów na właściwości mechaniczne oraz gazowe produkty degradacji termicznej***

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Recenzenci:

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– prof. dr hab. inż. Joanna Kałużna-Czaplińska (Politechnika Łódzka)

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Data i miejsce obrony: 2 grudnia 2024 r., Uniwersytet Mikołaja Kopernika w Toruniu, Wydział Chemii.

Celem pracy doktorskiej było zbadanie wpływu warunków procesu przetwórstwa przy użyciu wytłaczarki dwuślimakowej współbieżnej na właściwości tworzyw polimerowych, takich jak polietylen małej gęstości (LDPE) i polilaktyd (PLA), oraz ich degradację i powstające produkty gazowe tego procesu. LDPE jest powszechnie stosowanym, tanim tworzywem syntetycznym, natomiast PLA jest najbardziej popularnym polimerem biodegradowalnym.

W ramach rozprawy doktorskiej zbadano wpływ temperatury wytłaczania, szybkości obrotowej ślimaka oraz konstrukcji układu uplastyczniającego, w tym budowy ślimaka, na właściwości mechaniczne (udarność Charpy'ego, wytrzymałość na zginanie i rozciąganie), reologiczne (masowy wskaźnik szybkości płynięcia – MFR), termiczne (różnicowa kalorymetria skaningowa – DSC), a także masę cząsteczkową (chromatografia wykluczania – SEC) polimerów. Wykazano istotny wpływ konstrukcji ślimaka układu uplastyczniającego wytłaczarki na badane parametry. Temperatura wytłaczania i szybkość obrotowa ślimaków miały mniejszy wpływ na końcowy produkt. Kluczowym wskaźnikiem w analizie materiałów polimerowych był MFR.

Zbadano również produkty gazowe wydzielające się w trakcie procesu wytłaczania, są one cennym źródłem informacji o przebiegających reakcjach. W tym celu opracowano metodykę ich adsorpcji i analizy przy użyciu chromatografii gazowej sprzężonej ze spektrometrią mas (GC/MS). W badanych próbkach zidentyfikowano alkany, alkeny, ketony, alkohole mono- i polihydroksylowe, kwasy karboksylowe oraz związki cykliczne. Dominowały węglowodory o masie cząsteczkowej powyżej C_{10}. W przypadku wytłaczania PLA charakterystycznym związkiem był monomer – laktyd (3,6-dimetylo-1,4-dioksano-2,5-dion). Zaobserwowano także 1,3-dioksan, 1,3-dioksolan oraz 2,2-dimetylo-1,3-dioksolan, co wskazuje na degradację polimeru podczas wytłaczania. W trakcie przetwórstwa LDPE wydzielały się alkohole jednowodorotlenowe i diole, a także alkany o długości łańcucha powyżej C_{13}, również świadczące o degradacji materiału. Liczba związków ubocznych zwiększała się wraz ze wzrostem temperatury wytłaczania i szybkości obrotowej ślimaka. Analiza produktów gazowych wydzielających się podczas wytłaczania jest niezwykle istotna także ze względu na ich potencjalną szkodliwość dla osób zajmujących się procesami przetwórczymi, umożliwi dobór odpowiednich środków ochronnych.

Otrzymane wyniki pozwoliły na określenie wpływu poszczególnych parametrów procesu przetwórstwa na degradację materiału i wynikające z niej właściwości tworzywa. Umożliwiły również optymalizację warunków prowadzenia procesu wytłaczania LDPE i PLA przy użyciu wytłaczarki dwuślimakowej współbieżnej, co przyczyni się do ograniczenia zużycia surowca i energii oraz zmniejszenia ilości powstających odpadów przemysłowych, a tym samym wpłynie na obniżenie kosztów produkcji.

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TWORZYWA W LICZBACH

Tabele 1–4 zawierają dane dotyczące wielkości produkcji surowców i półproduktów chemicznych (tab. 1) oraz najważniejszych tworzyw polimerowych i polimerów (tab. 2), a także wybranych wyrobów z tworzyw polimerowych (tab. 3) i gumy (tab. 4) w styczniu 2025 r.

T a b e l a 1. Produkcja surowców i półproduktów chemicznych w styczniu 2025 r., t
T a b l e 1. Production (tons) of raw materials and chemical intermediates in January 2025

Artykuł	Średnia miesięczna w 2024 r.	Styczeń 2025 r.	% I 2025/ I2024
Węgiel kamienny	3 685 345	4 043 731	97,8
Węgiel brunatny	3 418 819	3 932 217	110,9
Ropa naftowa – wydobycie w kraju	50 587	56 063	95,7
Gaz ziemny – wydobycie w kraju (tys. m^3)	402 935	466 358	98,5
Etylen	28 610	22 729	73,2
Propylen	32 222	32 500	117,1
1,3-Butadien	4 393	4 105	89,0
Fenol	3 148	3 429	89,3
Izocyjaniany	238	234	108,3
ε-Kaprolaktam	8 617	8 298	104,4

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T a b e l a 2. Produkcja najważniejszych tworzyw polimerowych i polimerów w styczniu 2025 r., t
T a b l e 2. Production (tons) of major polymer materials and polymers in January 2025

Tworzywo polimerowe/polimer	Średnia miesięczna w 2024 r.	Styczeń 2025 r.	% I 2025/ I2024
Tworzywa polimerowe	261 577	256 680	99,3
Polietylen	26 062	22 753	78,4
Polimery styrenu	12 449	12 391	95,7
Poli(chlorek winylu) niezmieszany z innymi substancjami, w formach podstawowych	17 594	12 450	89,6
Poli(chlorek winylu) nieuplastyczniony, zmieszany z dowolną substancją, w formach podstawowych	3 322	2 944	93,7
Poli(chlorek winylu) uplastyczniony, zmieszany z dowolną substancją, w formach podstawowych	8 205	7 101	86,1
Poliacetale, w formach podstawowych	19	12	42,9
Glikole polietylenowe i alkohole polieterowe, w formach podstawowych	7 488	7 122	99,6
Żywice epoksydowe, w formach podstawowych	931	778	84,7
Poliwęglany	1 531	1 737	93,8
Żywice alkidowe, w formach podstawowych	2 031	2 346	107,9
Poliestry nienasycone, w formach podstawowych	7 654	6 609	85,6
Poliestry pozostałe	4 899	5 105	109,7
Polipropylen	25 693	29 634	136,3
Polimery octanu winylu w dyspersji wodnej	3 618	3 650	103,6
Poliamidy 6; 11; 12; 66; 69; 610; 612, w formach podstawowych	17 116	19 034	106,9
Aminoplasty	20 365	24 280	116,2
Poliuretany	1 689	1 985	138,6
Kauczuki syntetyczne	22 309	25 365	124,9

Wg danych GUS.

T a b e l a 3. Produkcja wybranych wyrobów z tworzyw polimerowych w styczniu 2025 r.
T a b l e 3. Production of some polymer products in January 2025

Wyrób	Jednostka	Średnia miesięczna w 2024 r.	Styczeń 2025 r.	% I 2025/ I 2024
Wyroby z tworzyw polimerowych	tys. zł	6 828 748	13 706 769	206,6
Rury, przewody i węże sztywne z tworzyw polimerowych	t	27 420	23 595	117,3
w tym: rury, przewody i węże z polimerów etylenu	t	10 481	8 928	102,2
rury, przewody i węże z polimerów chlorku winylu	t	8 693	7 547	144,5
Wyposażenie z tworzyw polimerowych do rur i przewodów	t	4 342	4 027	107,4
Płyty, arkusze, folie, taśmy i pasy z polimerów etylenu, o grubości < 0,125 mm	t	52 127	56 933	102,6
Płyty, arkusze, folie, taśmy i pasy z polimerów propylenu, o grubości ≤ 0,10 mm	t	14 183	14 333	111,6
Płyty, arkusze, folie, taśmy i pasy z komórkowych polimerów styrenu	t	37 884	31 570	123,8
w tym: do zewnętrznego ocieplania ścian	t tys. m²	13 115 8 858	10 793 7 106	122,5 115,6
Worki i torby z polimerów etylenu i innych	t	27 059	27 476	102,0
Pudełka, skrzynki, klatki i podobne artykuły z tworzyw polimerowych	t	24 293	24 294	101,1
Pokrycia podłogowe (wykładziny), ścienne, sufitowe	t tys. m²	8 903 2 183	9 627 2 241	120,8 102,8
Drzwi, okna, ościeżnice drzwiowe	t tys. szt.	46 097 805	35 996 666	97,7 98,7
Okładziny ścienne, zewnętrzne	t tys. m²	299 107	196 47	140,0 261,1
Kleje na bazie żywic syntetycznych	t	6 472	8 808	206,9
Kleje poliuretanowe	t	1 492	1 483	102,8
Włókna chemiczne	t	2 863	2 952	132,3
Tkaniny kordowe (oponowe) z włókien syntetycznych	t tys. m²	1 332 4 251	1 465 4 676	180,2 179,7
Nici do szycia z włókien chemicznych	t	13	37	82,6

Wg danych GUS.

T a b e l a 4. Produkcja wybranych wyrobów z gumy w styczniu 2025 r.
T a b l e 4. Production of some rubber products in January 2025

Wyrób	Jednostka	Średnia miesięczna w 2024 r.	Styczeń 2025 r.	% I 2025/ I 2024
Wyroby z gumy, produkcja wytworzona	t	82 308	54 606	91,5
Opony i dętki z gumy; bieżnikowane i regenerowane opony z gumy	t tys. szt.	41 666 4 388	28 556 3 878	90,4 104,5
w tym: opony do samochodów osobowych	tys. szt.	2 353	1 820	95,4
opony do samochodów ciężarowych i autobusów	tys. szt.	272	239	97,0
opony do ciągników	tys. szt.	7	4	83,3
opony do maszyn rolniczych	tys. szt.	35	27	84,8
Przewody giętkie wzmocnione metalem	t	1 612	864	89,0
Taśmy przenośnikowe	t km	4 129 2 316	2 911 1 881	77,7 102,3

Wg danych GUS.

mgr inż. Małgorzata Choroś

Polish roads could be better even today

To produce a fiber-based additive for asphalt pavements that ensures high durability and quality, approximately 8,000 end-of-life tires are needed for every one kilometer of road constructed. The innovative solution, developed by Recykl O.O. S.A., is based on reinforcing synthetic fibers recovered from used tires. This material significantly reduces the formation of ruts and potholes, which are typically expensive to repair and appear seasonally across road networks. The additive, marketed under the name Smapol, has been tested and certified by the Road and Bridge Research Institute (IBDiM) in Warsaw and officially received a National Technical Assessment. It has already been integrated into asphalt mix designs by industry leaders such as Strabag, and successfully applied to dozens of road sections in Poland. Furthermore, its usage has extended abroad, notably to India, whose road network spans over 5.8 million kilometers. The use of synthetic fiber additives such as Smapol brings multiple advantages: it increases resistance to rutting, enhances resistance to freezing and thawing, and offers bigger resistance to weather-related wear and repeated vehicle loading. As a result, road maintenance costs are significantly reduced over time. According to Anna Krajewska, Marketing Manager at Recykl, they are, in effect, eliminating the root causes of systematic road repairs. At the same time, the company is resolving the environmental problem caused by the tens of thousands of tires discarded each year into forests, illegal dumps, or makeshift flowerbeds. Krajewska also emphasizes the regulatory potential. Sometimes it would be enough to include the requirement to use a stabilizing additive derived from recycled tires in the technical specifications for road construction or renovation projects. Today, the most commonly used additives in stone mastic asphalt (SMA) are cellulose-based fibers, which serve primarily to prevent asphalt binder from draining off aggregate during mixing, transport, and laying. However, these fibers absorb water, are prone to accelerated aging, and are difficult to store in damp environments. Przemysław Zaprzalski from Recykl explains, that cellulose consists of short fibers and cannot provide structural reinforcement throughout the mixture. In contrast, tire-derived fibers are longer, more durable, and highly resistant to typical operating conditions on roads - such as oils, greases, salts, water, sun exposure, and both high and low temperatures. Thanks to these characteristics, Smapol ensures around 20% improvement in structural strength and up to 30% better rutting resistance, while also increasing the moisture resistance and low-temperature cracking resistance of asphalt mixtures. These improvements result in an estimated 25–40% increase in the overall durability of road surfaces, yielding substantial economic benefits. To illustrate, in 2021 the Polish Government Road Development Fund allocated PLN 2.8 billion to investments and repairs made on 4,300 km of roads. Had Smapol been used across part of this network, an additional 1,000 to 1,700 kilometers of roads could have been modernized with the same budget. What is important, the adoption of Smapol does not require investment in new machinery. It is fully compatible with existing systems for dosing SMA stabilizers. Moreover, its low hygroscopicity ensures that the granules maintain performance even when exposed to moisture - allowing for open storage without loss of quality. The success of Smapol demonstrates how sustainable solutions, rooted in recycling, can enhance infrastructure resilience, optimize public spending, and support environmental goals, all while strengthening the technical performance of modern roadways.

https://www.plastech.pl/

Agreement between Mapro Polska and Gollmer Formen

Gollmer Formen GmbH, a leading expert in international project planning and sourcing of injection molds from China, Vietnam, India, and Eastern Europe, is strengthening its presence on the Polish market through a new collaboration with Mapro Polska. At this year's Plastpol trade fair, visitors of Mapro's booth had the opportunity to see Gollmer Formen's innovative "cup crushing mold" in action, operating on a Zeres V 1500/640 injection molding machine. In the company booth were presented the latest technologies from the Haitian Group, offering attendees a comprehensive look at the newest achievements in the industry. With deep expertise in global mold sourcing, Gollmer Formen GmbH goes beyond supply, offering complete, customer-oriented solutions. The company's headquarters in Kirchheim unter Teck features a fully equipped after-sales workshop, enabling precise and efficient implementation of mold modifications and updates. Thanks to close cooperation with Haitian and Mapro Polska, Gollmer Formen now delivers fully integrated turnkey packages - comprising injection molding machines, molds, and automation - from a single source. These solutions offer clear benefits: significantly reduced time-to-market, improved production efficiency, and direct support from the technical experts at Gollmer Formen and Haitian/Mapro Polska. Clients also gain a cost advantage through access to competitively priced molds sourced globally. By working hand in hand with Haitian International and Mapro Polska, Gollmer Formen is able to deliver solutions tailored to specific customer requirements, helping manufacturers enhance the efficiency and competitiveness of their production processes.

https://www.plastech.pl/

Valuable resources left as waste in polish forests

Over the past decade, Poland has lost more than half a billion euros due to inadequate recycling of metal, glass, and plastic packaging. Valuable raw materials that could be reintegrated into the circular economy and benefit the

national budget are instead left as litter, polluting forests and damaging the environment. The Polish Recycling Association is calling for legal reforms to close loopholes in the waste management system and stop the flow of packaging waste into illegal dumping sites. As springtime encourages people to explore the outdoors, forest visitors are increasingly met with disturbing scenes of scattered waste and unauthorized landfills. These pollutants not only destroy natural landscapes but also make serious threats to ecosystems – releasing toxins into the soil and water, increasing fire hazards, and endangering wildlife. The scale of the problem is alarming. According to the State Forests, between 80,000 and 120,000 cubic meters of waste have been removed from Polish forests annually since 2009. In 2023 alone, the volume reached 80,000 cubic meters – the equivalent of nearly 900 full semi-trailers. Both individual items and larger illegal dumping sites contribute to the threat, with the Central Statistical Office estimating that such sites covered as much as 192 hectares in 2022. These materials range from biodegradable waste to highly persistent and hazardous ones - aluminum cans, glass bottles, construction debris, and even toxic chemicals. This highlights the complex social and environmental challenge that forest littering represents. Solving it effectively requires not only education but also firm systemic action. Packaging waste also represents a significant financial burden. Over the past ten years, Poland has lost an estimated €54 million from uncollected glass, €120 million from metal packaging, and nearly €340 million from PET plastic containers. This places Poland fifth in Europe in terms of the value of wasted recyclable materials. These are resources that could have remained in circulation for years, had they been properly collected and processed, instead of polluting the environment or being incinerated with mixed waste. The financial impact extends beyond lost materials. The country also bears the cost of cleaning up illegal dumps and removing waste from natural areas, in addition to paying heavy fines for failing to meet EU recycling and recovery targets. Despite being obligated to implement Extended Producer Responsibility (EPR) regulations, Poland has yet to enforce a system that effectively holds producers responsible for the packaging they place on the market. Under EPR rules, companies profiting from packaging should also bear responsibility for managing the resulting waste. However, low fees and weak enforcement mean that many producers neglect eco-friendly packaging design and proper waste collection. Instead, the burden falls on municipalities and residents, who manage the household packaging waste. Industry groups emphasize that countries which have fully implemented EPR – with high fees for introducing new packaging and strict regulatory enforcement – have seen significantly better recovery rates and higher-quality recycled materials. Work on EPR legislation in Poland remains unfinished, despite the January 2023 deadline. A similar delay affects the implementation of the national deposit return system. Although a law for its introduction was signed in 2024, its launch has been repeatedly postponed. Recycling organizations warn that every day of delay leads to further environmental degradation and groving financial losses. Without swift action, Poland risks falling further behind in building a sustainable, circular economy.

https://www.plastech.pl/

Mark Winkler appointed Executive Commercial Director at Grupa Azoty Polyolefins S.A.

Mark Winkler has taken on the role of Executive Commercial Director at Grupa Azoty Polyolefins S.A., as announced via his LinkedIn profile on April 21, 2025. Prior to this appointment, he served as Key Account Manager for Europe, where he was responsible for expanding polypropylene sales across the region. Winkler steps into his new position during a key phase of the company's growth, as it continues to advance the "Polimery Police" project - Poland's largest petrochemical investment and one of the most significant undertakings of its kind in Central and Eastern Europe. The project encompasses the production of propylene via PDH technology and high-quality polypropylene, with an annual capacity of up to 437,000 tonnes. In May 2024, the company announced that it had surpassed 100,000 tonnes of polypropylene produced during the commissioning phase. Grupa Azoty Polyolefins sales its products under the Gryfilen brand, which includes a broad portfolio of polypropylene types – ranging from homopolymers to impact and random copolymers. These materials are aimed at a variety of industries including packaging, automotive, construction, and medical. A key strategic priority for the company is to grow exports and expand its presence in Western European markets. Supporting this goal is a state-of-the-art marine terminal in the Port of Police, enabling efficient international logistics. Winkler has been an active representative of the company on the international stage, notably speaking at the AMI Polymer Sourcing and Distribution conference in Hamburg in 2023, where he discussed the evolving polyolefin market in Eastern Europe and the importance of the Polimery Police project. The expansion of domestic polypropylene production is particularly significant for Polish converters, as it reduces dependency on imports, stabilizes pricing, and shortens supply chains. In parallel, Grupa Azoty Polyolefins continues to advance its sustainability agenda, including plans for ISCC Plus certification and the use of feedstocks derived from chemical recycling.

https://tworzywa.online/

ABC Technologies completes acquisition of TI Fluid Systems

Canadian company ABC Technologies has finalized the acquisition of UK-based TI Fluid Systems in a deal valued at over £1.8 billion. The newly merged entity will

operate under the name TI Automotive, a well-recognized industry brand that underscores the strong engineering and technical heritage of both companies. With combined revenues of $5.4 billion and a workforce of 34,600 employees across 26 countries, the group is set to become a global leader in automotive systems and solutions. The transaction has particular significance for Poland, where TI Poland Sp. z o.o. – previously part of TI Fluid Systems – operates six key locations. These include a Technology Center in Kraków and manufacturing facilities in Bielsko-Biała (two sites), Wieprz, Swarzędz-Jasin, and Wyszków. Together, they employ approximately 2,000 people and produce critical components for modern vehicle systems, such as fuel tanks, fuel pumps and modules, and fluid transfer systems - primarily made from high-performance plastics. Under the leadership of Terry Campbell, former CEO of ABC Technologies, the new TI Automotive group will focus on advancing lightweight component technologies and fluid management systems for internal combustion, hybrid, and electric vehicles. Poland is expected to play a key role in this strategy, thanks to its strong engineering talent and well-developed manufacturing infrastructure. Plastic components developed by TI Automotive are essential to reducing vehicle weight and improving energy efficiency. Innovations such as battery cooling systems and integrated plastic modules for electric vehicles are creating new opportunities for the Polish operations, positioning them as strategic contributors to the group's future growth.

https://tworzywa.online/

Bogucki Folie launches new high-speed flexographic press

Bogucki Folie, one of Poland's leading manufacturers of plastic films, has officially announced the launch of its new flexographic printing press – the Novoflex M10-1. The news was shared on the company's LinkedIn profile on April 16, 2025. Although the machine was delivered and installed in 2024, it has now been fully integrated into the production lines and has begun regular operation. The Novoflex M10-1, manufactured by Germany's Windmöller & Hölscher, is a state-of-the-art 10-color flexographic press equipped with advanced technologies for high-speed, precision printing. The system operates at speeds ranging from 500 to 800 meters per minute and can work with a maximum print width of 1300 mm. This level of performance is made possible through the use of electric ink pumps, extensive automation, and innovative drying chambers, which maintain stable print parameters even at top speeds. Previously, Bogucki Folie primarily relied on the FISCHER & KRECKE SD5 FP 36S-10 – another 10-color press known for its high-quality output and accuracy. That machine operated at a maximum speed of 400 m/min and was equipped with an advanced vision camera system to support quality control. The introduction of the Novoflex M10-1 represents not only a technological upgrade but also a significant expansion of the company's production capacity. In its announcement, Bogucki Folie emphasized that the investment will enhance its ability to meet growing market demands, reduce lead times, and improve flexibility in serving a wider range of print projects. The implementation of the machine was carried out by the company's own technical and managerial teams. The launch of this new press is in accordance with Bogucki Folie's long-term development strategy, which focuses on continuous investment in advanced technologies to increase both production capabilities and product quality. This move also sends a strong positive signal to the domestic plastics processing industry, highlighting that Polish packaging manufacturers remain competitive and committed to innovation.

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End of production of AGD in two Polish cities

At the end of April 2025, Turkish conglomerate Beko Europe will cease manufacturing operations at two major home appliance factories in Poland – in Łódź and Wrocław. This decision will result in the loss of approximately 1,800 jobs, causing significant challenges for local communities and the broader industrial sector, particularly plastics processing companies. According to Beko, the closures are a response to a "changing market and weakening demand for products manufactured in Poland," which have led to substantial, multimillion-euro losses over recent years. The factory in Łódź, which produces cookers, dryers, and plastic components, will be shut down completely. In Wrocław, the refrigerator plant and some office positions will also be phased out. Going forward, production will be maintained at two other sites: the modernized Wrocław facility, which will continue producing cookers, and a plant in Radomsko. Meanwhile, the Shared Services Center in Łódź and the commercial division will remain operational. This shift will have direct consequences for Poland's plastics processing sector. Household appliance factories like Beko's are major consumers of plastic parts – including housings, panels, insulation, and structural components used in washing machines, refrigerators, ovens, and dryers. As production winds down, demand for such components will drop, potentially dealing a short-term blow to local processors that supply the appliance industry. Beko's decision also fits into a broader and increasingly concerning trend within the Polish white goods sector. For several years, Poland had been the largest producer of major household appliances in the European Union. However, according to Eurostat, in 2024, China overtook Poland in terms of EU imports, particularly in categories such as refrigerators and washing machines. Further complicating the problem are rising production costs in Europe, including Poland, and a declining demand both domestically and across the EU. In response to market pressures,

Amica, one of Poland's largest appliance manufacturers, has also announced plans for group layoffs. The APPLiA Polska industry association has been calling for support measures for the sector for months, including incentives for energy-efficient appliances and subsidy programs. While Beko has promised to support laid-off employees and cooperate with labor unions, the impact on the supply chain and subcontractor networks will be far-reaching. Particularly vulnerable are plastic processing firms that invested in dedicated production lines and molds tailored specifically to appliance components. Nevertheless, not all segments of the market are facing decline. There is growing interest in compact, energy-efficient appliances for households, as well as increased demand in the premium segment. This shift could create new opportunities for flexible suppliers. The key to survival – and growth – in this changing landscape will be the ability to adapt quickly: shortening production runs, diversifying client portfolios, and exploring new markets, such as automotive, HVAC, or technical packaging.

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M. Sc. Mateusz Borkowski

WORLD NEWS

Sidel's Super Combi overcomes space constraints at Coca-Cola FEMSA

Coca-Cola FEMSA, one of the world's largest Coca-Cola bottlers, serves over 270 million consumers with a diverse portfolio of 134 beverage brands - including carbonated soft drinks (CSD), water, juices, teas, and energy drinks. Operating across 56 production plants and 249 distribution centers throughout Latin America, the company ensures wide access to its extensive offering. As the Latin American market for CSDs continues to grow fueled by shifting consumer preferences, especially among younger audiences, and broader economic recovery - Coca-Cola FEMSA is ready to meet the increasing demand. To boost production capacity and efficiency, the company has installed Sidel's Super Combi at its Jundiaí facility in Brazil, further enhancing operations following a successful implementation of the same solution on a water line in its Bauru plant. Sidel's Super Combi is an all-in-one solution that integrates five essential modules - preform feeder, blower, labeller, filler/capper, and cap feeder - into a compact and intelligent system. This space-saving design reduces the requied floor space by up to 30% compared to standalone equipment, making it an ideal fit for Coca-Cola FEMSA's needs for bigger efficiency and space optimization. The new solution replaced the plant's previous wet block equipment and was easily integrated into the existing production layout. Since installation, the line now operates at an impressive etticiency of 39,000 bottles per hour – an unprecedented level of productivity for FEMSA's CSD operations. It also supports up to 10 different bottle formats, ranging from 0.2 to 2 liters, while minimizing line footprint and maximizing facility space usage. The Jundiaí installation also incorporates Sidel's BlendFILL system, which merges mixer and filler tank functionality into a single module. This innovative design simplifies operations, reduces equipment footprint, cuts operational costs, and lowers system complexity. Additionally, it plays a key role in reducing CO_2 emissions and water consumption during cleaning cycles. To further enhance performance, Coca-Cola FEMSA has implemented Sidel's Evo-ON® Care and Performance applications, providing actionable insights to resolve performance dips and optimize line efficiency. This advanced digital solution improves overall equipment effectiveness (OEE) by enabling better monitoring, understanding, and resolution of machine inefficiencies. Coca-Cola FEMSA also uses 100% recycled PET (rPET) preforms for bottle production, and Sidel's Super Combi is fully compatible with rPET, ensuring optimal resource use while supporting sustainability goals — all without compromising performance.

https://www.plastech.pl/

Demand for food-grade recyclates to reach 1.6 million tonnes by 2029

In 2024, according to the latest Smithers report "The Future of PCR for Food-Grade Applications to 2029", global consumption of food-grade recycled packaging materials reached 1.0 million tonnes. Growing demand from food and beverage brands has driven the market at a compound annual growth rate (CAGR) of over 9% since 2019. Looking ahead, the market is projected to grow at a CAGR of 9.2% from 2024 to 2029, with consumption expected to reach 1.6 million tonnes by the end of the forecast period. This increase in demand is accelerating investments in mechanical and chemical (advanced) recycling lines, state-of-the-art sorting systems, and deposit return schemes — all aimed at progressing towards a truly circular plastic economy. The food-grade recyclates market is heavily dominated by a single polymer: polyethylene terephthalate (PET). In 2024, global PET recyclate consumption totaled 786,100 tonnes, accounting for 76.3% of the entire market. PET re-

mains popular due to its ease of processing, high contaminant removal efficiency in standard mechanical recycling lines, and broad availability of post-consumer raw material. PET is also expected to remain the fastest-growing segment over the next five years. In contrast, polyethylene (PE) and polypropylene (PP) face slower growth due to sorting and decontamination challenges in current mechanical recycling systems. Europe currently leads the global market, representing 65.4% of total food-grade recyclate sales by volume, and will remain the largest regional market through 2029. Newly implemented targets under the Packaging and Packaging Waste Regulation (PPWR) for 2025 and 2040 are expected to drive further demand, with Europe projected to consume 1 million tonnes of food-grade recyclates by 2029. Other key growth markets include the Asia-Pacific region, particularly countries with regulatory frameworks in place such as Australia, Japan, and South Korea. Beverages are the leading application segment, accounting for 46% of global consumption in 2024, with PET bottles being the primary end use. From 2019 to 2024, the average recycled content in beverage packaging grew at 10% annually, though a slightly slower rate is expected in the coming years. Food packaging, including trays and other rigid containers, forms the second-largest segment, representing 34% of total consumption in 2024.

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Dassault Systèmes launches global SolidWorks SkillForce initiative

Dassault Systèmes has announced the launch of SolidWorks SkillForce, a new global initiative designed to provide SolidWorks application licenses to students participating in internships, enabling them to gain practical professional experience. As an industry-first project, SolidWorks SkillForce will benefit interns, companies, and the industry at large by equipping the workforce of the future with design, engineering, and manufacturing skills needed to drive innovation in the generative economy. Through SolidWorks SkillForce, Dassault Systèmes will provide SolidWorks licenses to students who have earned the Certified SolidWorks Associate (CSWA) certification and are participating in internships or co-op programs lasting 3-6 months. They will have access to the software for the duration of their internship, allowing them to directly apply their skills in a professional environment. By providing software licenses to interns, the initiative supports companies hosting interns, removing software access barriers and fostering a more productive internship experience. As technologies evolve and workplaces transform, students can train, earn their CSWA certification, and start their internships with their own SolidWorks license. This enables them to gain industry experience, enhancing their career prospects. For companies, the initiative offers the benefit of hosting CSWA-certified interns, who, with access to SolidWorks applications, will bring a higher skill level and bigger productivity. The initiative aims to bridge the engineering talent gap by enabling students to gain practical experience working with AI-driven virtual twin technologies, used by millions of professionals across the industry. Additionally, the project encourages students to earn the CSWA certification as a proof of professional qualification. The company is committed to shaping the workforce of tomorrow, equipping students with the skills they need to design their career path and succeed in the workforce, said Gian Paolo Bassi, Senior Vice President, Customer Role Experience at Dassault Systèmes. SolidWorks SkillForce creates a bridge between education and industry, giving interns and co-op students the opportunity to use SolidWorks applications and make a real impact on the companies and projects they engage with. Dassault Systèmes unveiled the SolidWorks SkillForce initiative during 3DExperience World, the annual conference for the SolidWorks user community and 3DExperience platform. At the event, students had the chance to connect with industry leaders in design, engineering, and manufacturing, as well as visit the 3DExperience Edu Zone to test applications, view demonstrations, and receive career advice.

https://www.plastech.pl/

Kia concept EV2 blends bio-based materials in innovative interior

The Concept EV2 electric SUV recently unveiled by Kia reflects the automaker's vision for urban mobility and responsible design, highlighted by an innovative interior that incorporates bio-based materials such as Fybron from Simplifyber. Besides this cellulose-based moldable fiber material, the Concept EV2 also incorporates mycelium-based materials (mushroom/hemp composites) from Bulgaria's Biomyc, and ampliTex, a bio-based composite material made from flax fibers by Bcomp that was also used in previous Kia concept cars. Concept vehicles offer designers the freedom to explore and present innovative materials, serving as a platform to experiment with new ideas that reflect the long-term direction for future production models. Color, materials, and finish play a key role in this approach. The Concept EV2's interior combines innovation and responsible design, with Kia's CMF team working closely with partners to introduce environmentally conscious materials that enhance the driving experience while aiming to reduce environmental impact. One standout material is Simplifyber Fybron, a next-generation cellulose-based compound used for the vehicle's dashboard and door panels. Made from renewable sources like wood, paper, and recycled textiles, this material reduces reliance on traditional plastics and ensures the vehicle's interior is both environmentally sound and durable. This innovative material enhances the tactile experience with its soft, premium feel, offering a cleaner, more environmental alternative to conventional materials while maintaining long-lasting performance. Its warm, refined texture reportedly delivers a perfect balance of comfort and technical elegance. In collaboration with Kia partner Biomyc, Kia biodegrad-

able mycelium (mushroom root) parts also feature in the Concept EV2's interior. These parts are carefully cultivated and custom-colored to match Kia's specific Pantone shades, creating a cohesive and visually refined interior. Two distinct types of mycelium materials are used. The first is a mycelium-infused polyurethane (PU), applied across the overall light blue surfaces in the interior. Fine brown speckles – actual mycelium particles – are embedded throughout, adding natural texture and depth. The second is a "grown volume material," created by mycelium cells that grow and bind in situ to cellulose from agricultural waste, thereby forming a solid structure. This magic renewable material's natural thermal insulation properties make it ideal for use in door armrests, where it demonstrates both function and environmental properties. It can be used in combination with plant-based agricultural byproducts such as straw, corn husks, and hemp. Kia's collaboration with Bcomp has been extended to incorporate ampliTex, a recyclable bio-based composite material made from flax fibers, into key structural components within the Concept EV2's cabin, such as the back-seat shell and front-seat substructures. Replacing conventional synthetic materials significantly reduces the overall weight of the vehicle while maintaining levels of strength and robustness required from a lifestyle-focused SUV. This not only enhances fuel efficiency but also supports a more environmentally conscious vehicle lifecycle. Kia's CMF team has also worked to develop a custom dark-blue finish, adding an aesthetic layer that complements the vehicle's eco-friendly design without sacrificing visual appeal.

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Acrylonitrile: 70% of new capacity in China

China is on track to significantly increase its acrylonitrile production capacity by 2030, driven by strong demand from the automotive and industrial sectors. According to the analytical firm GlobalData, the country is set to account for over 70% of the global planned capacity expansions, making it a key player in the global market. In the latest GlobalData report titled "Acrylonitrile Industry Capacity and Capital Expenditure Forecasts with Details of All Active and Planned Plants to 2030," it is forecasted that China will see an increase in acrylonitrile production capacity of 2.44 million tons per year (mtpa) from 2025 to 2030, driven by eight planned projects.

Nivedita Roy, an oil and gas analyst at GlobalData, emphasizes, that acrylonitrile is a key chemical precursor used in the production of various polymers and fibers, such as acrylics, ABS (acrylonitrile-butadiene-styrene), and carbon fiber. It has applications across many industries, from automotive to consumer goods. The growth of these industries, which heavily rely on acrylonitrile-derived products, is fueling the rapidly increasing demand for this raw material in China. The largest planned capacity expansion in China is set to come from the Zhejiang Petrochemical Daishan Acrylonitrile Plant 2, with a capacity of 0.66 mtpa. The operator of the plant will be Zhejiang Petrochemical Co Ltd, with the acrylonitrile production expected to begin later this year. The second-largest project is the Fujian Gulei Petrochemical Company Zhangzhou Acrylonitrile Plant, which is expected to start production in 2030 with an annual capacity of 0.40 mtpa. Additionally, four other companies – Hengli Petrochemical, Jilin Petrochemical, Lihuayi Group, and Sinochem Quanzhou Petrochemical – plan to build plants with an identical production capacity of 0.26 mtpa each. All four facilities are scheduled to begin operations later this year.

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Borealis unveils new recycled linear low density polyethylene grade

Borealis has unveiled its new recycled linear low density polyethylene grade (rLLDPE). The Austria-based polyolefin producer's new grade utilizes 85% post-consumer content and has been developed with mechanical recycling technology. Ideal for blown film applications across various packaging levels, the Borcycle M CWT120CL grade can also be used in stretch film, stretch hood, and film applications for the agricultural, industrial, and protective sectors. Borealis and Ecoplast, an Austrian recycler the company acquired in 2018, have collaborated on this project since 2022. After working for two years to overcome challenges like incorporating high proportions of recycled content while also meeting the performance demands of flexible packaging, the duo created a material with high stretchability made possible by the low gel content. Additionally, the solution offers a high toughness-stiffness balance. The polyolefin producer claims the solution meets the EU Packaging and Packaging Waste Regulation (PPWR) without compromising performance levels. The regulation came into force on February 11th and will apply from August 12th, 2026. Peter Voortmans, Commercial Director Consumer Products Flexibles at Borealis said, that with its impressive 85% post-consumer recyclate content, this new rLLDPE grade represents a major step on the path to a circular economy for plastics. Borcycle M CWT120CL will help our customers meet their sustainability targets while maintaining the high-performance standards required for demanding flexible packaging applications - just one of the ways we're re-inventing essentials for sustainable living.

https://interplasinsights.com/

Cedo strengthens leadership in flexible plastic film circularity with Plasta Group acquisition

Cedo has announced its acquisition of one of Europe's largest polyethylene recyclers, producers, and suppliers of sustainable plastic products, Plasta Group. The move strengthens the sustainable FMCG private label solutions

specialist's position as a leading flexible plastic films circularity provider in Europe. Additionally, Cedo has expanded its presence in Central and Eastern Europe (CEE) and Scandinavia. The combined organisation boasts an annual capacity to recycle over 200,000 tons of plastic waste. Plastic bags made with recycled contents can then be manufactured, as well as other film-based products. Cedo can now offer an expanded range of sustainable solutions that meet the growing demand for circularity in flexible plastics. According to Thierry Navarre, CEO of Cedo, Plasta Group's expertise and shared commitment to sustainability align perfectly with their vision. This partnership strengthens our ability to lead the circular economy in flexible plastics sector, delivering innovative solutions to the customers and creating a more sustainable future. Based in Vilnius, Lithuania, Plasta Group operates modern manufacturing plants in Lithuania and Sweden. With a 60-year history within the industry, the company employs over 500 skilled professionals, recycles over 45,000 tons of post-consumer waste plastic, and produces more than 36,000 tons of refuse sacks and film products. Plasta Group is well-known for its sustainability efforts, holding EcoVadis Silver, ISO 9001, 14001, 45001, Blue Angel, RAL, and RecyClass certificates.

M. Sc. Mateusz Borkowski

TECHNICAL NEWS

Syensqo introduces its Ryton polyphenylene sulfide coating grade

Syensqo has announced the launch of a new grade of its Ryton® polyphenylene sulfide (PPS) coatings, developed to solid robust performance while streamlining application processes. The new formulation enables effective coating at lower film builds, significantly enhancing deposition efficiency per pass. This advancement reduces both the time and resources required for coating operations, without compromising throughput or protective performance. According to Syensqo, the newly developed Ryton PPS M200 FP answers a growing demand across industries for high-performance coatings that are easier to apply and come with a reduced health, safety, and environmental (HSE) footprint. The company explained that the solution builds on its established PPS chemistry, offering strong barrier properties and excellent resistance to corrosive chemicals. In addition, the material ensures reliable adhesion to metals and sustained operation at temperatures of up to 200°C. Designed as a sustainable, low-volatility powder coating, Ryton PPS M200 FP combines high molecular weight with safe handling characteristics. Syensqo emphasized that the formulation enhances binding efficiency while minimizing the need for post-curing after film formation, making it ideal for large-scale or high-demand coating operations. The company highlighted that this new PPS grade significantly extends the application potential of Ryton coatings, especially for challenging environments such as those found in the oil and gas industry. It provides applicators with a safer, more manageable process and is now commercially available worldwide. With this latest development, Syensqo continues to reinforce its position as a leader in advanced performance materials, offering innovative, application-ready solutions for industrial coatings.

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LEGO makes progress on sustainability

The LEGO Group has taken a significant step toward sustainability by introducing more eco-friendly materials into its products, starting with a selection of LEGO toy car tyres. Initially, seven types of LEGO tyres have been redesigned to include at least 30% of recycled content. These newly engineered tyres incorporate materials such as discarded fishing nets, ropes from ocean vessels, and recycled engine oil. The company noted that the new tyres are completely indistinguishable from their conventional counterparts in terms of look and feel and are already being included in LEGO sets currently on the market. LEGO expects these more sustainable tyre versions to be featured in approximately 120 different sets by the end of 2025, with broader plans to expand recycled content across other product lines in the future. Annette Stube, Chief Sustainability Officer at the LEGO Group, explained that this development marked an important milestone in the company's long-term goal of reducing dependence on virgin fossil fuels. She said that LEGO had spent the past five years rigorously developing and testing the new material to meet the brand's high standards for quality, safety, and durability. The tyres, she added, represent just one of several innovative solutions being explored to make LEGO products more sustainable. The tyres are made using rSEBS (recycled styrene-ethylene-butylene-styrene), a material that aligns with LEGO's broader environmental strategy. The company clarified that there was no single solution to sustainability, which was why it continued to test and adopt a va-

riety of alternative materials across its product lines. To date, LEGO has tested over 600 different materials in its pursuit of reducing environmental impact. In the second half of last year alone, around 30% of all resin purchased by the company was certified under mass balance principles, reflecting an average of 22% from renewable sources. Other materials already in use include bio-polyethylene (bio-PE), which has been part of LEGO production since 2018. Derived from Brazilian sugarcane, bio-PE is used in soft, flexible pieces such as botanical elements and minifigure accessories. The company currently uses bio-PE in over 200 different elements. LEGO has also incorporated recycled artificial marble (arMABS) into transparent elements, such as lightsabres, windscreens, and windows, since 2024. These components now include 20% of recycled content, with more than 900 arMABS elements in production. The goal is to have these appear in over 85% of LEGO sets. Furthermore, LEGO is working with industry partners to develop new materials like e-methanol, produced by combining renewable energy with CO_2 sourced from bio-waste. This substance can be used to make ePOM, which the company plans to introduce in parts such as wheel axles in the near future. Acknowledging that sustainability cannot be achieved in isolation, LEGO stated that it would continue to collaborate closely with suppliers, research institutions, and other industries. These partnerships are essential in developing new materials and refining existing ones as the company pushes forward in its mission to transition to renewable and recycled resources.

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PCS introduces Lase One micro welder for precision assembly and repair

PCS Company, a leading supplier of solutions for the injection molding and die casting industries, has expanded its product portfolio with the launch of the Lase One micro welder - a high-precision spot plasma welding unit tailored for complex assembly and repair applications across a wide range of materials and part sizes. According to PCS, the Lase One has been engineered to offer the weld quality and performance typically associated with pulsed YAG lasers, but without the high costs and maintenance requirements. The company emphasized that the fully electric system provided mold makers and manufacturers with an affordable, reliable alternative for applications that demand precision and repeatability. The Lase One delivers up to 300 joules of energy and features independently adjustable welding power and weld times, with pulse durations ranging from 0.1 to 10 milliseconds. These capabilities make it suitable for both micro and large-scale welds, allowing for fine-tuned control in assembly or repair tasks. PCS highlighted several key benefits of the system, including precise parameter adjustment for delicate or challenging jobs, compatibility with a variety of metals, including ferrous, non-ferrous, and even precious metals like gold and silver and the absence of overheating risks or part deformation during use. Customers can purchase the Lase One either as a standalone unit or as part of a complete welding kit. The full kit includes a generator, microscope with clamping stand, welding torch, clamping ground, regulator, and an accessory kit - providing all the essential tools for immediate deployment in professional settings. Headquartered in Fraser, Michigan, PCS is a member of the Misumi Group. The company has been serving the plastics injection molding, mold making, and die casting markets since 1950, offering a wide array of products that include mold bases, components, molding supplies, hot runner systems, cutting tools, and additive manufacturing solutions. With branch operations in Michigan and California, and an expanding presence in Canada and Mexico, PCS continues to support manufacturers across North America with both standard and custom solutions backed by expert technical support.

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Glass powder additive increases antimicrobial properties of plastics

LG Electronics is taking a significant step in the expansion of its advanced materials business with the global launch of PuroTec, an antimicrobial glass powder designed for use in a variety of B2B applications. The material, which offers both antibacterial and antifungal properties, is intended for integration into plastics, paints, rubber, and other substrates across several industries. The company introduced PuroTec at Chinaplas 2025, held at the Shenzhen World Exhibition and Convention Center in Shenzhen, China. At the event, LG demonstrated the powder's potential in sectors such as home appliances, construction materials, medical devices, and textiles, emphasizing its versatility and effectiveness even when used in small quantities. The company noted that PuroTec helps prevent common microbial-related issues like odors, contamination, and discoloration, while maintaining the aesthetic and functional qualities of the host material. According to LG, PuroTec is the result of its in-house expertise in glass powder technology, originally developed for its own line of home appliance products. Since the commercial launch of PuroTec in 2023, the company has expanded its presence in markets across Asia, including China, Vietnam, and India. LG currently holds around 420 patents related to this technology, with intellectual property filings dating back to 2006. Baek Seung-tae, head of LG's Kitchen Solution Business, stated that the company planned to continue advancing material technologies to meet the evolving demands of global B2B customers. He indicated that such innovations would play a key role in LG's strategic move beyond traditional home appliances and into a broader number of industries.

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Continental develops key fob with 100% bioplastic housing

Continental's Automotive group sector has unveiled a new vehicle key fob featuring an outer casing made entirely from bioplastic, marking a notable step in the company's ongoing efforts to enhance the environmental sustainability of its products. The casing is manufactured from polyamide 11 (PA11), a renewable biopolymer derived from castor oil, and replaces the traditionally used fossil-based polyamide 12 (PA12). The innovation forms part of Continental's internal "design for environment" initiative, launched in 2021, which is focused on identifying materials and design strategies that reduce the environmental footprint of its products. As part of this program, the company aims to increase the use of renewable and recyclable materials across its portfolio. Jean-Francois Tarabbia, Head of Architecture and Network Solutions, stated that Continental remained committed to delivering sustainable products and solutions. He said that the introduction of the bioplastic key fob represented a concrete step toward reducing reliance on fossil-based materials and was contributing to broader climate protection goals. The selected material, PA11, is notable for being made from 100% bio-based feedstock and is fully recyclable at the end of its life cycle. The castor plant used in its production can be cultivated in arid regions without irrigation and does not contribute to land degradation, resulting in the material's low environmental impact. The product has already earned recognition, having been nominated for the 2024 German Sustainability Awards, and is part of Continental's long-term ambition to transition from conventional materials to bio-based and circular alternatives. The company has outlined a goal of achieving full circularity across its product lines and resource cycles by 2050, working in close collaboration with partners throughout its value chain.

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Award-winning flood protection made from recycled plastic

A new stormwater management system developed by UWR has gained international recognition after winning in the "Transport and Process & Control" category at the 2025 Aquatech Innovation Awards in Amsterdam. The system, which helps reduce urban flooding risks by storing or transporting excess rainwater underground, features a customised recycled polypropylene (PP) developed by Polykemi and Rondo Plast. The modular system comprises square units stacked below ground to form flexible water infrastructure capable of withstanding heavy loads from above. To achieve the required mechanical strength and stiffness, UWR partnered with Polykemi and Rondo Plast to develop a REZYcom PP material, reinforced with glass fibres, tailored to the application's demanding specifications. Polykemi and Rondo Plast representatives noted that the material offered high stiffness and excellent consistency between production batches, ensuring reliable performance across all deliveries. They highlighted that the technical properties of the recycled compound allowed the modules to be installed relatively shallowly, thereby reducing excavation costs and the environmental impact of soil transport.

UWR emphasised that the choice of material not only contributed to climate adaptation but also significantly improves the sustainability profile of the system. The company reported that using the recycled PP blend had enabled a CO_2 footprint reduction of 65–70% compared to conventional materials. The product also delivers superior longevity, with an expected lifespan of 75 years, far exceeding the typical 25–30 years of similar systems currently available on the market. The collaboration between UWR and its material suppliers was key to achieving these results. The development process involved extensive testing and close cooperation with Polykemi's laboratory and technical teams. Site visits by UWR and its clients helped ensure that the material met all performance expectations. Having launched production in October 2023, UWR is now delivering its award-winning system to projects across Denmark, Norway, the UK, Portugal, the Netherlands, and Germany. The recognition from Aquatech is seen by both UWR and its suppliers as validation of their shared commitment to innovation, sustainability, and urban resilience. Polykemi expressed pride in the collaboration, stating that UWR's success serves as a strong endorsement of the material supplier's direction and values, particularly in helping clients implement climate-smart solutions with high-performance recycled materials.

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Moldable cellulose liquid targets synthetic fiber replacement

Materials innovation startup Simplifyber has secured $12 million in Series A funding to accelerate the development of its groundbreaking 3D-molding process aimed at transforming the production of soft goods. The funding round was led by Suzano Ventures, the investment arm of Brazil-based wood pulp giant Suzano S/A, marking their first investment in the company. Other participating investors included At One Ventures, Techstars, Plug and Play Sustainability Fund, One Small Planet, Staddle Holdings, Collateral Good, M.I.H. Capital, Overlay Capital, and Meliorate Partners. This latest investment follows a $4.2 million seed round completed in July 2022. Founded in 2021, Simplifyber has developed a proprietary liquid natural fiber material called Fybron, which is injected into 3D molds to form soft goods. This eliminates the need for traditional manufacturing steps like spinning, weaving, cutting, and sewing. The result is a more streamlined, sustainable production method using fully bio-based and biodegradable materials. The company has

already shown the potential of its process in the fashion industry. Its first commercial demonstration - a cellulose-based shoe upper - was revealed during Paris Fashion Week in 2024, in collaboration with fashion brand Ganni. With the new funding, Simplifyber plans to expand its R&D, increase manufacturing, grow its team, and establish pilot production facilities. The goal is to bring its technology closer to cost parity with conventional textile production, while pursuing new opportunities across industries such as apparel, footwear, and automotive interiors. Suzano Ventures said it sees Simplifyber as a standout player in the rapidly growing bio-based materials sector. The firm noted that after reviewing hundreds of startups in the space, Simplifyber's disruptive approach to replacing synthetic fibers stood out. According to Suzano, the investment is in accordance with its mission to support sustainable innovation and reduce dependence on fossil-based materials. Simplifyber's latest milestone signals growing momentum in the shift toward low-impact, circular manufacturing processes for consumer and industrial goods.

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Polyvel efficiently and cost-effectively produces extra soft, nonwoven PP products

Masterbatch specialist Polyvel has introduced a new line of softening agents that enable the efficient, cost-effective production of extra-soft polypropylene (PP) nonwoven fabrics. These newly developed process aids are designed to help fibre manufacturers deliver a soft-touch finish for applications in hygiene, healthcare, and beyond. The company said the additives were ideal for PP nonwoven products where a soft surface feel was critical, such as in diapers, hygiene textiles, and medical materials. However, their use also extends to automotive interiors, furniture upholstery, construction, and technical textiles. Polyvel noted that the softening agents – such as Polyvel NH-P01 – required only a small dosage (as low as 0.5%) to be effective, eliminating the need for traditional plasticisers. The additive migrates to the fibre surface during extrusion, preventing brittleness and delivering a consistently smooth, soft surface. Following testing by independent laboratories, Polyvel confirmed that additives were harmless to human skin, PFAS-free, food-safe, and contained no substances listed as SVHCs (Substances of Very High Concern) by the European Chemicals Agency (ECHA). This makes them particularly suitable for sensitive applications, including baby care products. Polyvel added that interest was growing in bioplastics like PLA, and its broad masterbatch portfolio was designed to support evolving market needs. The company said that its materials offered tailored functionality to help meet the technical and environmental requirements of emerging sustainable products. With these softening agents, Polyvel aims to support manufacturers in delivering comfort, safety, and quality across a wide range of PP nonwoven applications.

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WYNALAZKI / INVENTIONS

Sposób wytwarzania wielofunkcyjnego nawozu na bazie komunalnych osadów ściekowych – Artur Krasiński, Damian Simiński, Ryszard Sobierajski, Jakub Sobierajski, Krzysztof Juszkiewicz, Marta Stechman, Joanna Gluzińska, Marek Szpilka (Zgłoszenie Nr 445816, Sieć Badawcza Łukasiewicz – Instytut Nowych

Syntez Chemicznych, Puławy, Mineralica Sp. z o.o., Nowogard)

W sposobie wg wynalazku surowe osady ściekowe o zawartości suchej masy 8–46% doprowadza się znanymi metodami, w szczególności przez uśrednienie zawiesin o rożnych zawartościach suchej masy, do zawartości suchej masy w zakresie 17–23%cz. mas., higienizuje się otrzymaną mieszaninę dodając świeżo palone wapno w ilości 0,66–0,7 części m/m w przeliczeniu na masę surowego osadu i miesza dotąd, aż temperatura mieszaniny osiągnie 80°C. Następnie do mieszaniny dodaje się 0,12–0,25 części m/m nadziarna z granulacji produktu, 0,5–0,7 części m/m torfu, 0,505–0,55 części m/m roztworu krzemianu potasu oraz 0,15–0,2 części m/m superfosfatu wzbogaconego o zawartości 46% P_2O_5 i 0,05–0,2 części m/m mocznika lub 1,16–1,4 części m/m 50% struwitu, uzyskując mieszankę pregranulatu. Poddaje się ją granulacji z rozfrakcjonowaniem granulatu na produkt właściwy o uziarnieniu 1–5 mm, nadziarno i podziarno, a następnie suszy się produkt właściwy otrzymując produkt końcowy (wg Biul. Urz. Pat. 2024, nr 6, 10).

Sposób otrzymywania biodegradowalnych otoczek na bazie chitozanu do nawozów azotowych oraz kompozycja na bazie chitozanu – Ilona Wandzik, Danuta Gillner, Agata Wawoczny, Regina Michalik, Jarosław Janik, Gracjan Rożański (Zgłoszenie Nr 445793, Politechnika Śląska, Gliwice; Grupa Azoty Zakłady Azotowe Kędzierzyn S.A., Kędzierzyn-Koźle)

Przedmiotem zgłoszenia jest kompozycja chitozanowa z dodatkiem mieszaniny eutektycznej, charakteryzująca się tym, że zawiera 5–30% cz. mas. mieszaniny eu-

tektycznej powstałej ze zmieszania i ogrzewania w temp. 60–90°C chlorku cynku i glikolu etylenowego, w stosunku molowym 1:4-1:6. Zgłoszenie obejmuje także sposób otrzymywania biodegradowalnych otoczek na bazie chitozanu do nawozów azotowych, polegający na tym, że do roztworu chitozanu w roztworze kwasu octowego o stężeniu 1–5% w/v dodaje się metodą rozpuszczalnikową 5–30% cz. mas. schłodzonej mieszaniny głęboko eutektycznej otrzymanej przez zmieszanie i ogrzewanie w temp. 60–90°C chlorku cynku i glikolu etylenowego, do osiągnięcia stanu jednorodnej cieczy. Całość miesza się w czasie 2–6h w temperaturze pokojowej po czym natryskuje na granule nawozu saletrzanego o wielkości granul 1–6 mm w urządzeniu fluidyzacyjnym, w temp. 40–60°C, przy przepływie powietrza 300–600 m^3/h, przepływie cieczy roboczej 0,7–2,5 l/h, suszy w złożu fluidalnym w czasie 15–45 minut (wg Biul. Urz. Pat. 2024, nr 6, 10).

Kompozycja elastomerowa przeznaczona na wyroby polimerowe o podwyższonej odporności na utlenianie oraz fotostarzenie – Małgorzata Latos-Brozio, Anna Masek, Michał Bocianowski (Zgłoszenie Nr 445761, Politechnika Łódzka)

Wynalazek dotyczy kompozycji elastomerowej przeznaczonej na wyroby polimerowe o podwyższonej odporności na utlenianie oraz fotostarzenie, zawierającej kopolimer etylenowo-norbornenowy oraz naturalny przeciwutleniacz, jako naturalny przeciwutleniacz oraz wysuszone i zmielone wytłoki z jabłek lub aronii w ilości 5–15 cz. mas. na 100 cz. mas. kopolimeru (wg Biul. Urz. Pat. 2024, nr 6, 13).

Sposób wytwarzania warstwowych materiałów kompozytowych Cu-TiC-TiN – Krzysztof Naplocha, Anna Dmitruk (Zgłoszenie Nr 445776, Politechnika Wrocławska)

Zgłoszenie dotyczy sposobu otrzymywania porowatych i litych hybrydowych materiałów kompozytowych na osnowie Cu umocnionej warstwami TiC i TiN, przy czym prowadzi się 3 etapy według wynalazku. Wynalazek może znaleźć zastosowanie w budowie elementów maszyn pracujących pod obciążeniem w podwyższonych temperaturach, od których wymagana jest m.in. zwiększona twardość, odporność na zużycie ścierne, stabilność wymiarowa i przewodność cieplna i elektryczna (np.: styki elektryczne do wózków widłowych i paletowych, odbieraki prądu z sieci trakcyjnej, startery silników, próżniowe wyłączniki mocy) (wg Biul. Urz. Pat. 2024, nr 6, 13).

Biokompozyt i sposób otrzymywania biokompozytu do wytwarzania produktów enzymatyczno-bakteryjnych oraz zastosowanie biokompozytu wraz z enzymami i bakteriami do kompostowania – Katarzyna Janczak, Daria Lisewska, Alicja Mazuryk, Kacper Fiedurek, Natalia Puszczykowska (Zgłoszenie Nr 445889, Sieć Badawcza Łukasiewicz – Instytut Inżynierii Materiałów Polimerowych i Barwników, Toruń)

Przedmiotem zgłoszenia jest biokompozyt do wytwarzania produktów enzymatyczno-bakteryjnych, zawierający co najmniej 38 cz. mas. skrobi ziemniaczanej lub kukurydzianej albo pszennej, 12–15 cz. mas. kredy, 10–15 cz. mas. makuch lnianych, 7–10 cz. mas. gliceryny, 5–9 cz. mas. mocznika, 5–8 cz. mas. oleju palmowego, 1–5 cz. mas. fusów z kawy naturalnej z ziaren kawowca lub zbożowej oraz 2–4 rodzajów enzymów z grupy proteaz w tym korzystnie proteinazę K i/lub papainę i/lub bromelainę i/lub nattokinazę w postaci płynnej lub proszkowej o zawartości enzymu w produkcie 50–20 000 jednostek aktywnych/g lub ml w ilości 0,0000002–0,8 cz. mas. na 100 cz. mas. granulowanego biokompozytu. Dodatkowo zawiera liofilizaty 2–5 rożnych szczepów bakterii *Bacillus cereus* i *Bacillus subtilis*, w tym co najmniej jeden szczep *Bacillus cereus* i co najmniej jeden szczep *Bacillus subtilis* w ilości 0,05–0,015 cz. mas. liofilizatu na 100 cz. mas. granulowanego biokompozytu. Przedmiotem zgłoszenia jest także sposób otrzymywania biokompozytu do wytwarzania produktów enzymatyczno-bakteryjnych oraz zastosowanie biokompozytu do kompostowania (wg Biul. Urz. Pat. 2024, nr 8, 11).

Kompozyt polilaktydu z opoką wapnistą jako napełniaczem, sposób jego wytwarzania oraz zastosowanie do produkcji wyrobów z tworzyw sztucznych – Bogna Sztorch, Robert Przekop, Julia Głowacka, Magdalena Kustosz, Natalia Kubiak (Zgłoszenie Nr 445828, Uniwersytet im. Adama Mickiewicza w Poznaniu)

Przedmiotem wynalazku jest kompozyt polilaktydu z opoką wapnistą jako napełniaczem na osnowie polilaktydu PLA, z dodatkiem wosku pszczelego lub wosku syntetycznego jako kompatybilizatorów, sposób jego wytwarzania oraz zastosowanie do produkcji wyrobów z tworzyw sztucznych. Kompozyt polilaktydu z opoką wapnistą jako napełniaczem na osnowie polilaktydu PLA składa się z 70–96,25% cz. mas. polilaktydu PLA i 30–3,75% cz. mas. opoki i/lub zawierających 1% cz. mas. w przeliczeniu na masę PLA/opoka wosku pszczelego lub wosku syntetycznego jako kompatybilizatorów. Sposób wytwarzania kompozytu w postaci koncentratu polega na tym, że 70% cz. mas. polilaktydu PLA podgrzewa się powyżej temperatury mięknienia do uzyskania polimeru w stanie uplastycznionym, dalej dodaje się 30% cz. mas. opoki wapnistej i/lub 1% cz. mas. wosku pszczelego w przeliczeniu na masę kompozytu PLA/opoka i/lub 1% cz. mas. wosku syntetycznego w przeliczeniu na masę kompozytu PLA/opoka. Następnie polimer wraz z napełniaczem miesza się do uzyskania jednorodnej masy, dalej studzi się, granuluje i suszy w podwyższonej temperaturze. Zastosowanie kompozytu polilaktydu z opoką wapnistą do druku 3D w postaci żyłki - filamentu, uzyskanego przez dodanie do koncentratów czystego polimeru polilaktydu PLA w odpowiednich stosunkach masowych do rozcieńczenia układów do stężeń 3,75% cz.

mas. opoki, 7,5% cz. mas. opoki, 15% cz. mas. opoki lub poprzez wytłoczenie koncentratu zawierającego 30% cz. mas. opoki (wg Biul. Urz. Pat. 2024, nr 8, 12).

Sposób otrzymywania sfer węglowych do adsorpcyjnego usuwania CO_2 z powietrza – Ewelina Kusiak-Nejman, Joanna Kapica-Kozar, Antoni W. Morawski, Urszula Narkiewicz, Agnieszka Wanag, Iwona Pełech (Zgłoszenie Nr 445907, Zachodniopomorski Uniwersytet Technologiczny w Szczecinie)

Zgłoszenia dotyczy sposobu otrzymywania sfer węglowych do adsorpcyjnego usuwania CO_2 z powietrza, poprzez reakcję kopolimeryzacji rezorcyny i reakcję polikondensacji w obecności formaldehydu, z zastosowaniem czynnika katalizującego. Reakcję kopolimeryzacji rezorcyny prowadzi się poprzez dodanie do 140 cm^3 wodnego roztworu etanolu 1 g rezorcyny, po czym mieszaninę poddaje się mieszaniu do momentu całkowitego rozpuszczenia rezorcyny. Następnie do roztworu rezorcyny dodaje się czynnik katalizujący i roztwór rezorcyny poddaje się mieszaniu przez 15 minut z szybkością mieszania 400 obr./min, a następnie dodaje się do niego 1,4 cm^3 37% roztworu formaldehydu i poddaje się sonikacji przez co najwyżej 5 minut. Tak otrzymaną zawiesinę poddaje się suszeniu w temp. 100°C przez 24 h. Wysuszoną żywicę uciera się i poddaje się kalcynacji w temp, 350°C przez 2 h, a następnie w temp. 700°C przez kolejne 2 h w atmosferze gazu obojętnego i tak otrzymaną sferę węglową poddaje się rozdrobnieniu. Istotą wynalazku jest to, że jako czynnik katalizujący stosuje się amonosilan w ilości 0,09625–1,54 cm^3, przy czym czynnik katalizujący dodaje się do roztworu rezorcyny o temperaturze pokojowej. Korzystnie jako aminosilan stosuje się (3-aminopropyl) trimetoksysilanu lub (3-aminopropyl)trietoksysilanu (wg Biul. Urz. Pat. 2025, nr 9, 12).

Sposób otrzymywania włóknin polimerowych modyfikowanych nanocząstkami dwutlenku tytanu i zastosowanie tych włóknin jako materiałów aktywnych fotokatalitycznie w procesach fotokatalizy – Jakub Trzciński, Kamil Czelej, Karol Ćwieka, Leon Gradoń, Łukasz Werner, Zuzanna Bojarska (Zgłoszenie Nr 447855, Politechnika Warszawska)

Przedmiotem zgłoszenia jest sposób otrzymywania włóknin polimeru termoplastycznego modyfikowanych nanocząstkami dwutlenku tytanu, gdzie przygotowuje się wodną zawiesinę nanocząstek dwutlenku tytanu o stężeniu cząstek w zakresie 0,025–0,25% cz. mas. i o pH w zakresie 3–8. Następnie sonifikuje się ją, po czym włókninę z polimeru termoplastycznego zanurza się w przygotowanej zawiesinie nanocząstek dwutlenku tytanu z szybkością w zakresie 5–100 mm/min. Włókninę z polimeru termoplastycznego poddaje się odwirowaniu obrotowemu. Kolejnym przedmiotem zgłoszenia jest włóknina otrzymana sposobem według wynalazku i zastosowanie włókniny jako materiałów aktywnych fotokatalitycznie w procesach fotokatalizy (wg Biul. Urz. Pat. 2025, nr 9, 12).

Sposób otrzymywania oligoestrów na bazie pochodnych kwasów tłuszczowych i ich zastosowanie – Patryk Dziendzioł, Ewa Pankalla, Sylwia Waśkiewicz, Katarzyna Jaszcz (Zgłoszenie Nr 445958, Politechnika Śląska, Gliwice; Grupa Azoty Zakłady Azotowe Kędzierzyn S.A., Kędzierzyn-Koźle)

Zgłoszenie dotyczy sposobu otrzymywania oligoestrów na bazie pochodnych kwasów tłuszczowych i ich zastosowanie. Proces prowadzi się dwuetapowo, ma pierwszym etapie nasycony dimeryzowany kwas tłuszczowy (H-DFA) poddaje się procesowi poliestryfikacji, przy udziale glikolu i innego kwasu dikarboksylowego, przy czym stosunek molowy dimeryzowanych tłuszczowych do innych kwasów dikarboksylowych wynosi 1:3–1:12 (korzystnie 1:4), a stosunek molowy glikolu do sumy kwasów mieści się w przedziale 1:1,03–1:1,20 (korzystnie 1:1,06). Proces prowadzi się w obecności katalizatora estryfikacji 0,05–0,5% cz. mas. (korzystnie 0,2% cz. mas.) w temp. 160–190°C, w atmosferze gazu obojętnego. Na drugim etapie do układu reakcyjnego *in situ* wprowadza się w nadmiarze 2-etyloheksanol w ilości obliczanej z stosunku ilości moli grup kwasowych do ilości moli grup hydroksylowych wynoszącej 1:1,10–1:1,35 (korzystnie 1:1,10) oraz korzystanie z katalizatorem transestryfikacji w ilości 0,05–0,4% cz. mas., przy czym reakcję estryfikacji z 2-elyloheksanolem prowadzi się w temp. 170°C w czasie co najwyżej 2h. Następnie w temp. 180–200°C, w zależności od zastosowanych reagentów i ich ilości w układzie reakcyjnym, nadmiar 2-etyloheksnolu oddestylowuje się w temp. 150–160°C, przy ciśnieniu p<50 mbar. Sposób otrzymywania oligoestrów na bazie pochodnych kwasów tłuszczowych polega na tym, że uwodorniony dimeryzowany kwas tłuszczowy (H-DFA), glikol, alifatyczny kwas dikarboksylowy oraz 2-etyloheksanol poddaje się reakcji poliestryfikacji i estryfikacji w temp. 160–190°C, w atmosferze gazu obojętnego w obecności katalizatora estryfikacji w ilości 0,10–0,50% cz. mas. (korzystnie 0,2% cz. mas.), przy czym stosunek molowy H-DFA do alifatycznego kwasu dikarboksylowego wynosi 1:1–1:12 (korzystnie 1:4), a stosunek molowy glikolu do sumy moli stosowanych kwasów wynosi 1:1,05–1:1,20 (korzystnie 1:1,06). Następnie wprowadza się 2-etyloheksanol w ilości obliczanej z stosunku ilości moli grup kwasowych do ilości moli grup hydroksylowych, wynoszącej 1:1,05–1:1,35 (korzystnie 1:1,15). Przebieg reakcji kontroluje się przez oznaczanie liczby kwasowej (LK), do której po uzyskaniu wartości 10 mg KOH/g dodaje się katalizator transestryfikacji w ilości 0,02–0,20% cz. mas. (korzystnie 0,04% cz. mas.) i proces prowadzi się w temp. 180–200°C. Nadmiar 2-etyloheksanolu oddestylowuje się w temp. 150–160°C, przy ciśnieniu p<50 mbar. Zgłoszenie zawiera także zastosowanie przedmiotowych oligoestrów jako plastyfikator do poli(chlorku winylu) lub jako środek smarny (wg Biul. Urz. Pat. 2025, nr 9, 21).

Mieszanina do wytwarzania materiału kompozytowego i materiał kompozytowy– Michał Oleksiewicz,

Piotr Dyba (Zgłoszenie Nr 445921, Thermoplast Technology Prosta S.A., Libiąż)

Wynalazek dotyczy mieszaniny do wytwarzania materiału kompozytowego zawierającej poliamidowy materiał matrycowy i wypełnienie w postaci włókien bazaltowych, materiału kompozytowego uzyskanego z tej mieszaniny. Mieszanina służy do wytwarzania kompozytowych elementów konstrukcyjnych, takich jak profile techniczne, w tym profile dedykowane do wykorzystania w stolarce otworowej (wg Biul. Urz. Pat. 2025, nr 9, 22).

Sposób wytwarzania spienionego polipropylenu o właściwościach przeciwgrzybiczych – Marcin Antos (Zgłoszenie Nr 445972, Antos Ryszard Firma Chemiczna Antos, Sitaniec)

Przedmiotem zgłoszenia jest sposób wytwarzania spienionego polipropylenu o właściwościach przeciwgrzybiczych, w którym w wyniku homogenizacji uzyskuje się mieszaninę polimerową, charakteryzujący się tym, że na pierwszym etapie, w ekstruderze ślimakowym mieszaninę polimerową zawierającą: 95–99% polipropylenu, 0,1–7% pigmentów barwiących, 0,1–3% dodatków funkcyjnych oraz 0,01–2% nanocząsteczek metalu o aktywności przeciwgrzybiczej podgrzewa się do temp. 180–340°C, przy ciśnieniu 3–16 MPa przez okres 3–15 minut. Uzyskane w ten sposób tworzywo polimerowe tnie się, aż do uzyskaniu granulatu, posiadającego średnicę pojedynczej granulki wynoszącej 0,5–6,5 mm. Na etapie drugim, tak uzyskany granulat przenosi się do autoklawu wysokociśnieniowego, w którym nasącza się go środkiem spieniającym w zawiesinie wodnej, w temp. 85–150°C, przy ciśnieniu 1,2–2,8 MPa. Następnie nasączony granulat poddaje się ekspandowaniu, a na końcu stabilizowaniu poprzez chłodzenie, aż do uzyskania granulatu w formie spienionej o gęstości nasypowej wynoszącej 22–240 g/l (wg Biul. Urz. Pat. 2025, nr 9, 22).

mgr inż. Małgorzata Choroś

NEW BOOKS

DEGRADATION, STABILIZATION, AND RECYCLING OF PACKAGING MATERIALS

Muhammad Rabnawaz, Susan E. M. Selke, Ian Wyman (Wiley)

2nd edition, 2025, 384 pages, 124.99 EUR

ISBN 9781394294268

ISBN 9781394294275 (e-Book)

The book analyzes packaging materials and their interactions with different environments, discussing the degradation processes of different materials like plastics, wood, paper, glass, and metal, providing specific strategies to address these degradation processes, and exploring solid waste management, recent developments in recycling, and the principles of eco-friendly packaging design. Organized into two parts, the first section of this book provides a comprehensive examination of how environmental factors such as heat, shear, light, air, packaged products, and stress affect packaging materials, focusing on the chemistry of their deterioration and stabilization methods. The second section explores solid waste management, recent developments in recycling, and key principles of eco-friendly packaging design, culminating in an extensive discussion of legal and regulatory aspects. The book includes case studies and problem sets in each chapter, with solutions to the problems in an appendix in the back of the book. This publication includes discussion on structure of tinplate and tin-free steel, corrosion in lacquered cans, and effects of producing, processing, and storing metals. It includes recyclable versus repulpable paper, uses of recycled papers, wet-strength papers, non-wood fibers as paper sources, and contamination issues with paper recycling. Authors discuss plastic recycling rates, plastic scrap exports in the US and abroad, chemical versus mechanical plastic recycling, hydrocracking of plastics, and PE and PET recycling. It also covers lightweight glass bottles, strategies to modify or strengthen glass, and the real recyclability of glass. Presenting advanced technical knowledge that demystifies the sustainable packaging landscape, this publication is a critical resource for researchers, students, and industry professionals in the field of materials science and packaging to evaluate challenges related to solid waste and devise effective disposal strategies.

SMART TEXTILES AND WEARABLES FOR HEALTH AND FITNESS

Editors: Jyotirmoy Pathak, Abhishek Kumar, Suman Lata Tripathi, Balwinder Raj (Wiley)

1st edition, 2025, 464 pages, 188.99 EUR

ISBN 9781394302949

ISBN 9781394302871 (e-Book)

This publication provides an in-depth exploration of how innovative technologies and materials are reshaping healthcare, making it an essential resource for anyone wanting to understand the transformative power of smart textiles and wearables in patient monitoring, diagnosis, and rehabilitation. Authors explores the transformative influence of flexible electronics on the healthcare field. The book's chapters include a broad spectrum of topics, each offering valuable perspectives on the intersection of textiles, wearables, and health technology. The book delves into the unique technologies and ma-

terials driving the flexible electronics revolution, offering insights into their development and applications. The study explores the diverse uses of intelligent textiles and wearable devices in healthcare, encompassing activities such as monitoring patients, diagnosing conditions, aiding rehabilitation, and administering therapeutic interventions. In this volume, we will explore the incorporation of sensors, biometrics, and biomarkers into textiles to showcase their capacity for immediate health monitoring and data collection. Additionally, we will explore the possible uses of smart textiles and wearables in managing with chronic diseases monitoring tracking sports and fitness activities, and facilitating human-computer interaction in medical settings. This book promises an engaging journey through the frontiers of technology, offering a comprehensive understanding of the transformative potential of smart textiles and wearables in revolutionizing healthcare delivery and improving patient outcomes.

MULTIFUNCTIONAL MATERIALS: ENGINEERING AND BIOLOGICAL APPLICATIONS

Editors: Divya Bajpai Tripathy, Anjali Gupta, Arvind Kumar Jain (Wiley)
1st edition, 2025, 528 pages, 194.99 EUR
ISBN 9781394234127
ISBN 9781394234141 (e-Book)

This comprehensive book is essential for anyone looking to deepen their understanding of advanced materials and their transformative impact across multiple disciplines, from cutting-edge technologies to innovative solutions in engineering and biology. The publication is a comprehensive guide on advanced materials, a class of materials that exhibit novel properties, high performance, and unique functionalities that make them suitable for a wide range of applications. These materials are typically engineered at the molecular or atomic level, allowing precise control over their structure and properties. The field of advanced materials is vast, covering a range of material types and applications. This volume covers topics on the chemistry, properties, and applications of advanced materials. The study of advanced materials involves multiple disciplines, including materials science, chemistry, physics, and engineering. Advances in this field have led to the development of new and improved technologies, such as high-efficiency solar cells, lightweight and strong materials for aerospace applications, and new drug delivery systems for disease treatment. This book is excellent source of information for researchers, industry scientists and engineers, academics, and postgraduate students working in the fields of materials chemistry, applied chemistry, nanotechnology, chemical technology, polymer science and engineering, and industrial chemistry.

PHTHALOCYANINE-BASED FUNCTIONAL POLYMERIC MATERIALS
Design, Synthesis, and Applications

Jianzhuang Jiang, Hailong Wang, Kang Wang (Wiley)
1st edition, 2025, 384 pages, 133.99 EUR
ISBN 9783527351220
ISBN 9783527840090 (e-Book)

In this book, a team of distinguished researchers delivers a comprehensive discussion of phthalocyanine-involving hybrids, molecular cages, coordination polymers, covalent organic frameworks, and organic polymers. The book also explains a diverse range of the applications of these novel materials in chemical sensors, organic catalysts, electrocatalysis, photocatalysis, energy storage, and more. The authors have included material designed to help improving the design of monomers to synthesize polymers with desired functionalities. A valuable reference in the development of phthalocyanine chemistry. Readers will also find a thorough introduction to phthalocyanine-based polymers and their uses in sensors, catalysis, energy storage, and other applications. It also include comprehensive explorations of the extended molecular systems of phthalocyanines, filling the gap between monomeric phthalocyanine compounds and polymers. Readers can find here a practical discussions of a variety of phthalocyanine-based polymer systems, their potential applications, and major design and synthesis challenges. This book provides a complete treatments of these novel materials appropriate for readers in academia and industry. It is a perfect book for polymer, organic, inorganic, catalytic, complex, and structural chemists. From this book will also benefit materials scientists and chemists working in industry.

MOLECULAR NANOGRAPHENES
Synthesis, properties, and applications

Editors: Nazario Martin, Colin P. Nuckolls (Wiley)
1st edition, 2025, 544 pages, 133.99 EUR
ISBN 9783527353224
ISBN 9783527845002 (e-Book)

Graphene, comprised of a single layer of carbon atoms in a honeycomb nanostructural arrangement, is the thinnest and strongest material yet known to science. Despite that this pristine carbon allotrope exhibits a variety of outstanding properties, its zero bandgap prevents its use for some optoelectronic applications. Fragments of graphene, or nanographenes, have shown a great potential to obviate these problems, thus paving the way for the development of chiroptical and optoelectronic properties. This book constitutes a comprehensive overview on the synthesis of these materials and their properties. Covering their widely varying morphologies, their potential applications, and their valuable chiroptical and photophysical features, it also analyzes multiple approaches to obtain nanographene by using both top-down and bottom-up methodologies. The result is a one-stop shop for material scientists and other researchers interested in these emergent and fascinating materials. Readers will also find a careful distinction between top-down and bottom-up approaches to nanographene synthesis. It also

provides a detailed discussion of nanographene configurations including planar, bilayer, helical, nanobelt, and many other geometries. An authorial team with pioneering research experience in the study of nano-sized graphenes and their synthesis provides an ideal for material scientists, polymer chemists, solid state chemists, organic chemists, and any other researchers looking to work with shape and size-controlled flakes of graphenes.

FUNCTIONAL POLYIMIDE DIELECTRICS
Structure, Properties, and Applications
Editor: Jun-Wei Zha (Wiley)
1st edition, 2025, 304 pages, 124.99 EUR
ISBN 9783527354337
ISBN 9783527849017 (e-Book)

In this book, author delivers an up-to-date and authoritative discussion of the latest advancements in the application of polyimide dielectrics (PIDs) in electrical and electronic equipment. Readers will find coverage of the application of PIDs in aerospace, high-temperature energy storage capacitors, corona-resistant motors, new energy power equipment, packaging, and more. The book serves as a valuable reference for improving the performance and expanding the application of existing PIDs, as well as designing and developing new PIDs. It also provides a current overview of research and frontier applications that will prove useful to students and researchers from multiple disciplines. In this book reader can find thorough introduction to the different types of polyimide dielectrics, including their synthesis, composites & blends, processing-property relationships, processing strategies and technologies, properties and applications. It also provides a comprehensive explorations of a wide range of PID applications, like in energy storage, insulation, thermal conductivity, intelligence, and more. It also supplies practical discussions of the environmental aspects of the technology, as well as life cycle assessmend and sustainable alternative possibilities. This publication is perfect for material scientists, electronics engineers, polymer chemists, physicists, and mechanical engineers. Professionals, engineers, and scientists working in the chemical industry will also benefit from the book.

ADDITIVE MANUFACTURING OF FUNCTIONAL POLYMERS AND NANOCOMPOSITES
Recent Progress, Applications, Challenges and Future Opportunities
Editors: Chaudhery Mustansar Hussain, Kalim Deshmukh (Elsevier)
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This publication provides up-to-date knowledge in this important research field. The book provides a comprehensive overview of the whole development phase, from material synthesis to component design and manufacturing and applications. The contents are divided into five key parts. This publication begins by introducing additive manufacturing of functional polymers and nanocomposites, highlighting the numerous developments and perspectives that have emerged over recent years. Then it explores the various types of functional polymers and nanocomposite materials, delving into their characterization and examining the synthesis techniques available for fabricating customized objects using additive manufacturing technologies. The discussion continues with an overview of the broad range of applications for these materials, covering sectors such as health care, electronics, automotive, robotics, aerospace, and other industries. Attention is also given to theoretical modeling and machine learning approaches, offering insights into the advanced methods being integrated into this field. Finally, the publication addresses key challenges, the environmental and health impacts, commercialization aspects, and the opportunities that lie ahead for the future development of functional polymer and nanocomposite additive manufacturing. This is a great source of information for academic and industrial researchers, material scientists and engineers, chemists, and mechanical engineers and all those working in the field of additive manufacturing of functional polymers and nanocomposite materials.

THREE-DIMENSIONAL GRAPHENE NANOCOMPOSITES
Design, Characteristics, and Technical Potential
Ayesha Kausar (Elsevier)
1st edition, 2025, 300 pages, 158.84 EUR
ISBN 9780443302152
ISBN 9780443302169 (e-Book)

Authors of this book explores the significant contributions of three-dimensional graphene and derived nanocomposites to the fields of nanoscience and technology. These materials are characterized by impressive structural, morphological, conductive, mechanical, thermal, and biological properties essential for creating high-performance nanocomposites. The research on these advanced materials has earned immense interest due to their exceptional physical attributes and cutting-edge applications, spanning from energy and environmental solutions to biomedical innovations. This book presents comprehensive information on the state-of-the-art of three-dimensional graphene nanocomposites. The volume provides thorough coverage of the structure, design, characteristics, and processing of these nanocomposites with inorganic nanoparticles (metal, metal oxide, MOF, etc.) and polymeric matrices (thermoplastics, thermosets, rubbery, and conjugating). It explains applications in energy storage and conversion devices (supercapacitors, lithium-ion batteries, solar cells, fuel cells), radiation protection, environmental purification (water/gas purification, gas sensing), and biomedical fields (tissue scaffolds, biosensing, drug delivery). Moreover, the book examines the industrial, commercial, economic, and future sustainability aspects of three-dimensional graphene-derived nanocom-

posites. This book is intended for researchers, scientists, and engineers from academia and industry including materials experts, physicists, chemists, biologists, and others dealing with fundamentals – to – applications of high-tech three-dimensional graphene based nanocomposites. Furthermore, this handbook can also be helpful for university courses/lectures to introduce the modern concepts of nanoscience/technological research regarding novel three-dimensional graphene nanomaterials.

ADVANCED COMPOSITE MATERIALS FOR WASTEWATER TREATMENT
Editors: Norzita Ngadi, R.A. Ilyas, Nur Hafizah Ab Hamid, S.M. Sapuan (Elsevier)
1st edition, 2025, 500 pages, 177.64 EUR
ISBN: 9780443336355
ISBN: 9780443336362 (e-Book)

This publication presents the latest technological advancements in this important research field. This book explores recent advances in manufacturing, fabrication, and the introduction of functional groups such as tailored layered double hydroxide (LDH)-based nanocomposites and three-dimensional hierarchical nanostructures. Among several discussed composites, those that show maximum efficiency, including graphene composites, bio-based composites (alginate, natural fiber, rubber, etc.); biochar; metal-organic frameworks; geopolymers; nanocomposites; and LDH, are all discussed. This book is an essential reference resource for researchers, scientists, and industrial professionals as well as postgraduate students providing them with an in-depth understanding of cutting-edge developments in this field. It provides readers with an overview of the evolution of composites in water and wastewater treatment applications.

M. Sc. Mateusz Borkowski