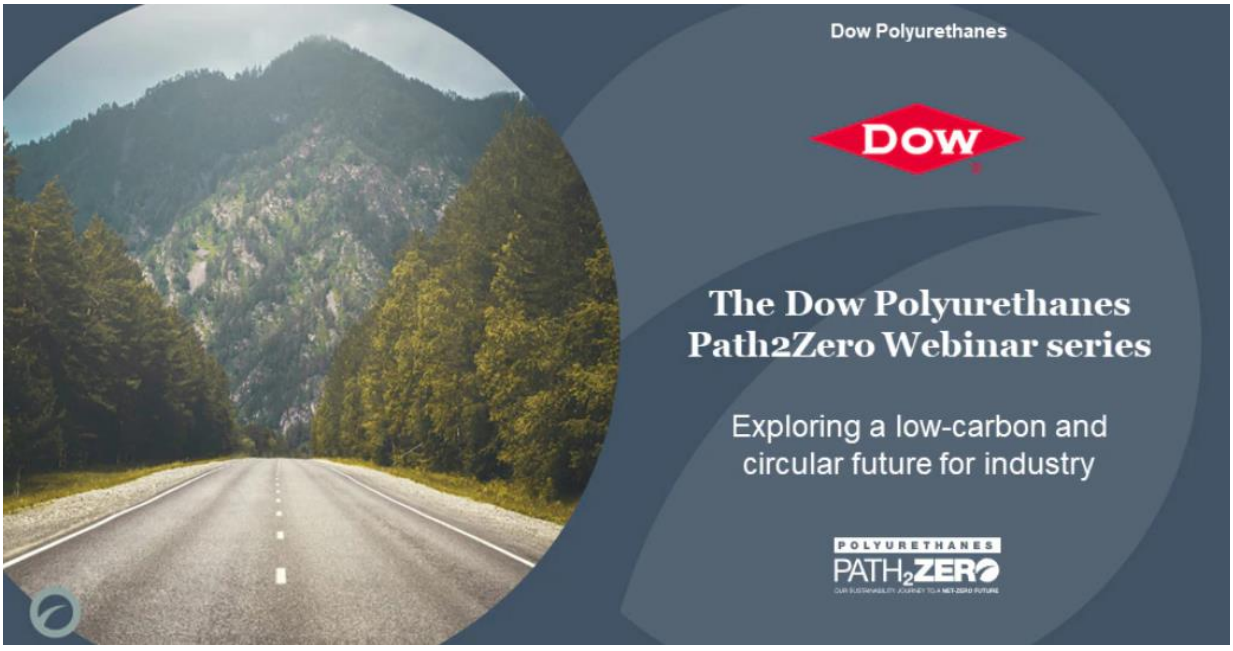
DOW

DOWFRIENDS Newsletter

Exploring a low-carbon and circular future for industry

With countless developments across an accelerating sustainability journey, it can be challenging to keep up with new advances. Dow continues to evaluate the current state of our industry and grow our range of products that meet sustainability requirements. Learn more in Dow's Path2Zero Webinar series.



Learn More

Dow named among the "PEOPLE Companies that Care®" for 4th consecutive Year

Dow has been named one of the 2023 PEOPLE Companies that Care by Great Place To Work® and PEOPLE, ranking #88 on the list of 100 companies.

Learn More

Dow innovations recognized with Sustainability Product of the Year awards from the Business Intelligence Group

Dow recently won two 2023 Business Intelligence Group (BIG™) Sustainability Awards. The recognition reflects continued progress in the Company's ambitious 10-year 2025 Sustainability Goals, which seek to enable the transition to a sustainable planet and society through science, innovation and collaboration. The Sustainability Awards honor those who have made sustainability an integral part of their business practices. Both of Dow's products won in the Sustainability Product of the Year category.

"It is an honor to be recognized by the BIG organization for our sustainable science for the fifth year in a row," said A.N. Sreeram, senior vice president, Research & Development, and chief technology officer for Dow. "Our customers increasingly demand higher performing products and solutions that are simultaneously sustainable to address our modern-day challenges. Dow is committed to deliver products and technologies that help our customers and value chain partners deliver more sustainable solutions to the world we share."

Learn more about Dow's 2023 Sustainability Award winners:

DOWSIL™ ICL Fluids for data centers is specifically engineered for use in immersion cooling servers as a single-phase dielectric coolant. It provides significantly improved compatibility to all server components including gaskets, tubing, sheathing, silicones, plastics, adhesives and rubbers. It also has a combination of outstanding thermal transfer properties including high thermal conductivity and specific heat capacity, relatively low viscosity, and good wetting property on the surface of

electronic parts. It is environment friendly with very low Global Warming Potential (GWP) and zero Ozone Depletion potential (ODP).

Dow SPECFLEX™ C for automotive applications reduces our dependence on fossil fuels through circular mobility solutions without any loss in quality or performance. Ahead of any competition, it uses circular feedstock sourced from the same mobility sector to enable a wide range of flexible foam solutions for comfort and acoustic purposes in interior, exterior, as well as powertrain solutions for transportation applications. SPECFLEX™ C Polyurethane MobilityScience products also reduce our carbon footprint together with circularity and promote automotive sustainability throughout vehicle lifecycles.

The Business Intelligence Group was founded with the mission to recognize true talent and superior performance in the business world. The organization's proprietary and unique scoring system selectively measures performance across multiple business domains and then rewards those companies whose achievements stand above those of their peers.

"Sustainability is more than an initiative and is now integral to most corporate cultures," said Maria Jimenez, Chief Nominations Officer, Business Intelligence Group. "We are so proud to reward and recognize all of our winners and finalists who have made it their mission to help protect our environment."

Visit Dow's website for additional information on the Company's commitment to Sustainability, R&D and ID&E, and to explore the Company's consolidated 2022 Intersections Progress Report.

The full list of winners may be viewed on the Business Intelligence Group website.

Link to the online article

Circularity: the key to advancing low-carbon mobility

"Recycling has become a crucial part of circularity, so it is important we do this efficiently with the lowest environmental impact. We need to ensure the fewest boundaries are put in place when designing a product for its first life. Especially for batteries, society must accommodate for this by removing some of the hurdles that are currently in place."

– Kurt Vandeputte, Senior Vice President, Battery Recycling Solutions, Umicore, and Board Member and Treasurer, Global Battery Alliance

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Electric vehicles (EVs) have emerged as a driving force behind reducing greenhouse gas emissions. But the industry-wide transition from to EVs is far more complex than simply perfecting a new type of car. For electrification to be a true enabler of sustainable mobility, we must address the current challenges at play - extending the life of existing vehicles while also enabling proper disassembly and recycling of its parts.

These challenges have served as the inspiration for the Sustainable Mobility Summit in Berlin, hosted by Dow ahead of the ABB FIA Formula E World Championship's Berlin E-Prix. Designed to bring together partners and organizations spanning the mobility value chain, the Summit sparked further dialogue on the significance of accelerating circularity strategies that ensure additional positive impact within the automotive industry, ultimately contributing to low-carbon mobility.

Above and Beyond Electric Vehicle: Extending EV Battery Lifespan

While electrification is one essential step in the world's transition to net-zero to mitigate climate change, EV manufacturing is intrinsically a resource-dependent process. Rare-earth magnets and raw materials like lithium, cobalt and graphite, essential for EV batteries, have a significant contribution to the impact of EVs throughout their life cycle.

One solution is to extend the usable life of existing parts, specifically enabling a second and third life in applications in and beyond mobility. Encouraging proper EV usage through consumer education, which includes charging 'etiquette', optimizing driving habits and regular maintenance, can all make a substantial difference. Furthermore, there is the power and potential of materials science. Our MobilityScience™ engineers are developing technologies that enhance the durability and longevity of car components.

The cost of extending the lifetime of EVs, however, must be balanced with the environmental gains of creating new, more efficient EVs. This is where prioritizing circularity in the design phase comes into play.

Enabling Recycling and Reuse of EV Batteries

Enabling recyclability is a crucial strategy to offset the initial environmental impact of material sourcing and manufacturing as well as reducing waste. Today, there are numerous EV components that hold significant potential for recycling and reuse.

Currently, a paradox exists where optimizing components for efficiency during their first place often hinders circularity at the end of life. Tearing down siloes and sharing best practices between companies across the value chain are critical to putting this paradox in the rearview mirror.

For example, Dow is working with partners to pioneer the use of circular materials in automotive solutions. One example is in the collaboration with automotive tiers Autoneum and Adient, where we created circular polyurethane solutions produced using a mass balance approach. Together, we were able to replace fossil carbon feedstock with virgin-type-quality materials that meet the same performance requirements while being sourced from a waste product of the mobility sector.

Looking at the EV battery, its early-stage design has a crucial role to play in enabling circularity. At Umicore, we have found that a modular battery is key in ensuring proper disassembly and parts recycling can take place at vehicle end-of-life. To accommodate this approach, disassembly must be thoughtfully planned for during design, which requires clear pathways to education and shared learnings between materials science companies like Dow, tier suppliers, OEMs, design companies, and regulatory bodies.

Working with regulators to adapt policy frameworks to accommodate these new design approaches is essential. The latest revision proposed to the End-of-Life Vehicles (ELV) Directive of the European Commission[1], for instance, will help promote the use of recycled materials in original vehicle designs, improve the traceability of ELVs to ensure proper recycling, and increase provisions to prepare materials for recycling. Improving existing policies and addressing obstacles within them is crucial to align societal goals with the economic viability of circular models. Achieving a global, unified policy environment for EV circularity in the coming years would be a significant step in the right direction.

As said: circular models represent our pathway to low-carbon mobility. Prioritizing circularity will help the industry be at the forefront of the crucial sustainability track of the EV movement, accelerating the reduction of environmental impact beyond tailpipe emissions.

Link to the online article

Dow wash-off label adhesive recognized for sustainable package design

- Association of Plastics Recyclers (APR) acknowledges Dow's innovative wash-off label adhesive suitability for clear PET bottle and filmic label recycling.
- INVISU™ 7007 adhesive combines high adhesion performance with design for recyclability.
- The certified solution addresses both converters' demand for reliable and high-performing label solutions as well as recyclers' needs for cleaner recycled materials.

INVISU™ 7007 wash-off pressure sensitive adhesive from Dow (NYSE: DOW) has received recognition from the Association of Plastic Recyclers (APR) as meeting or exceeding its most strict Critical Guidance Protocol for the recycling of clear PET articles with filmic labels and closures. APR's Critical Guidance Recognition is a widely accepted recyclability assessment for plastics packaging and is granted to companies whose products solve challenges in sustainable package design.

“Labels are a crucial part of packaging as they convey important information to the end user,” said Isabelle Uhl, R&D/TS&D Fellow at Dow Packaging & Specialty Plastics. “INVISU™ 7007 Water-Borne Label Adhesive combines high performance with recyclability, as we believe our customers should not have to compromise one for the other. We prioritize innovation to deliver quality solutions that utilize design for recyclability and help the industry meet their sustainability commitments."

Performance meets Recyclability

Production efficiency remains essential in label converting. As sustainability is a key focus for consumers and policymakers, companies are evolving to create solutions to meet new parameters, such as recycling protocols. Today, filmic labels can impact the recycling process when not properly separated from labelled items, and wash-off adhesives have proven a valid technology to allow clean label separation and therefore enable high quality recycling outputs.
“Converters need reliable label solutions for efficient adhesion and high-speed production, while recyclers want as pure recycling outcomes as possible to increase their yields,” added David Keely, Application Technology Leader Adhesives at Dow Packaging & Specialty Plastics. “When more applications are being made recyclable and better recycling outcomes are achieved, recycling rates will increase, fewer fossil fuels be needed, and everyone will benefit.“

INVISU™ 7007 Water-Borne Adhesive from Dow has been developed to address label recycling demands while expanding the possibilities of label performance. Featuring excellent adhesion and tack, high solids content for high-speed processing on state-of-the-art coating machines, INVISU™ 7007 wash-off label adhesive performs like available high-performing general purpose filmic label (GPFL) adhesives, while allowing for better recycling. As shown in testing trials, INVISU™ 7007 wash-off label adhesive allow for polyolefin-based (PE, PP) filmic labels to be separated during recycling in the washing step and to produce pure flakes for new materials.

“Dow aims to close the loop by enabling 100% of our products sold into packaging applications to be reusable or recyclable by 2035,” added Izzat Midani, Marketing Manager Adhesives at Dow Packaging & Specialty Plastics. “The APR certification for our INVISU™ 7007 wash-off label adhesive is a critical third-party validation which confirms that brand owners and converters can feel more confident in their choice to use our products to meet their sustainability targets.”

Dow collaborates with companies throughout the value chain at its Pack Studios innovation centers, where it tests and optimizes packaging and label technologies designed for recyclability, to help improve the circular economy for plastics. As a full-service supplier of both acrylic pressure sensitive adhesives and silicone release coatings, the company is helping customers maximize label and packaging cost efficiencies.

Learn more about INVISU™ Water-Borne Label Adhesives from Dow here. Explore this and other Dow label innovation at stand 7E41 at **Labelexpo Europe 2023** in September.

Link to the online article

Dow wins in multiple categories at the 2023 R&D 100 Awards

- Marks Company's 12th consecutive year making the list
- Wins in the inaugural R&D 100 Professional Awards
- Company also received a Special Recognition for Corporate Social Responsibility

Dow recently won five R&D 100 Awards, including three R&D 100 Product Awards, R&D Researcher of the Year for 2023 and a special recognition for Corporate Social Responsibility. Marking its 61st year, the R&D 100 Awards program is universally recognized as a highly prestigious accolade within the research and development (R&D) community. This program pays tribute to innovative pioneers and their impactful contributions to science and technology.
"We are very proud that Dow has earned recognition on the R&D 100 list for twelve consecutive years, and over that timeframe the Company's products, people and technologies have received 59 cumulative awards – the most of any company," said A.N. Sreeram, senior vice president, Research & Development, and chief technology officer for Dow. "Team Dow strives to develop more differentiated products and solutions for our customers while solving societal needs and creating value for our shareholders."

The R&D 100 Awards program is open to corporate, government, and academic R&D organizations across the globe. First established in 1963, the R&D 100 Awards is the only science and technology awards competition that recognizes new commercial products, technologies and materials for their technological significance that are available for sale or license.

This year, Dow continued its winning streak by securing three awards in the Mechanicals/Materials category, which comes after having 10 solutions showcased in the finalists round. Dow's Dr. Bharat Indu Chaudhary received the inaugural 'R&D Researcher of the Year Award' in the R&D 100 Professional Award category for his recent accomplishments in the design of the SI-LINK™ DFDF-5451 NT Faster Moisture Curing Ethylene-Silane Copolymer, which enables game-changing improvements in performance.

In addition to the award winners, Dow received special recognition in the Corporate Social Responsibility category for combating geographic inequality in remote areas by erecting high-

standard basketball courts from waste bicycle tires.. This honors an organization's efforts to be a greater corporate member of society, from a local to global level.

Read more about our 2023 R&D 100 Award-winning products and innovations:

Solventless Antimisting SYL-OFF™ SL 184 Release Coating is a technological advancement that solved the long-standing misting issue, enabled extreme speed production of Pressure Sensitive Adhesive labels with excellent coating performance. Fast curing, low release force at both low and high peel speeds, reduces downtime for a variety of applications such as pressure sensitive laminates.

DOW ENDURANCE™ HFDD-4201 Compound for Cable Systems is a fully formulated polymer compound for high voltage insulation designed for use in underground and undersea power cables up to 500 kV (500,000 volts). It is a novel, more sustainable, patented cross-linkable polyethylene formulation that provides more than 70% reduction in methane byproduct versus incumbent materials.

DOWSIL™ TC-4083 Dispensable Thermal Pad delivers a transformative combination of high thermal conductivity, excellent dispensability with patented thermal stability. This helps drive thermal management in 5G base station, ADAS and self-driving chipset for ever-increasing communication capacity and connectivity, the future of mobility to prevent deaths and injuries and improve driving comfort.

Visit Dow's website for additional information on the Company's commitment to Sustainability, R&D and ID&E, and to explore the Company's consolidated 2022 Intersections Progress Report.
The full list of winners may be viewed on R&D World.

Link to the online article

Dow partners with Qifan Cable to drive offshore wind power development

Supporting the global energy transition to less carbon-intensive systems

Dow, a global materials science company, and Shanghai Qifan Cable Co., Ltd. (Qifan Cable) have signed a strategic Memorandum of Understanding (MoU) at Wire China 2023. In the coming years, the two parties intend to jointly engage in developing innovative solutions for submarine cables, to support development of offshore wind power that will accelerate the global energy transition to renewable sources.

Under this cooperation, Dow would deliver ENDURANCE™ compounds used in the insulation of Qifan Cable's HVAC and HVDC submarine cables. Produced under superior cleanliness standards, ENDURANCE™ HFDD-4201SC enables high performance and longevity of the HVAC submarine cable for greater reliability. Moreover, it provides good degassing time and scorch resistance that results in production efficiency and shorter manufacturing cycles. For HVDC systems, ENDURANCE™ HFDB-4401UDC enables long-run performance and increased operating temperatures of up to 90°C.

According to the International Energy Agency's Electricity Market Report 2023, renewables' share of the power generation mix worldwide is set to rise from 29% to 35% by 2025, and offshore wind power is expected to grow rapidly as a predominant source of power generation that will support the global transition to less carbon-intensive and more sustainable energy systems.

"In response to the global energy transition, Dow has introduced a series of high-performance solutions that support emerging needs in sustainable energy sources such as offshore wind power," said **Bambang Candra, Asia Pacific Commercial Vice President of Dow Packaging and Specialty Plastics**, "This partnership with Qifan Cable represents the full recognition of Dow's submarine cable products, and at the same time, it also helps us advance our manufacturing operations. We continue to improve our product innovation to suit varying application needs while expanding cooperation with industry partners, to support the realization of global decarbonization goals."

Mr. Zhou Guihua, Chairman of Qifan Cable said, "In the field of submarine cable materials, Dow has industry-leading innovation capabilities and cutting-edge product technologies. Through our solid alliance with Dow, it will further strengthen our competitive advantage in the submarine cable market and promote closer cooperation in the value chain. We are delighted to drive the development of offshore wind power with Dow."

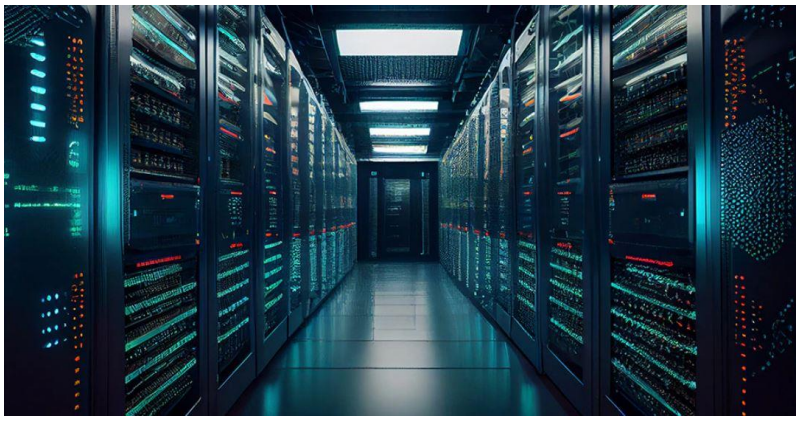
Through expertise in materials science, Dow works closely with partners like Qifan Cable to optimize efficiency in operations and accelerate renewable energy growth, enabling a lower-carbon economy that is essential in addressing climate change and achieving a sustainable future.

Link to the online article

Data center cooling: How to keep a data center operating efficiently

Our heat transfer fluids are helping datacom companies around the globe achieve power usage effectiveness targets while taking on increasing heat loads.

THE CHALLENGES OF CONTROLLING TEMPERATURES IN DATACOM EQUIPMENT



The continuous advancement of micro-processor technology to support Artificial Intelligence, Internet-of-Things, and the overall acceleration of digital platforms has led to increasing heat loads incurred by Datacom Equipment Cooling Systems (DECS). Today, the majority of DECS are using air-cooling techniques, which is resource-intensive and not effective enough to deal with increasing heat loads. Given these trends, and as server rack densities approach and exceed 30 kW, the need for liquid cooled infrastructure is critical.

DIRECT-TO-CHIP LIQUID COOLING PROVIDES A SOLUTION

A hybrid approach to server cooling will be a likely solution inside an individual data center, with air and direct liquid cooling coexisting. “After years of collaboration with industry experts, Dow has launched DOWFROST™ LC Heat Transfer Fluid, specifically formulated for liquid cooled, ‘direct-to-chip’ applications”, said Jordan Rau, Marketing Manager for Heat Transfer Fluids.

DOWFROST™ LC provides the following benefits to customers who are making the switch to liquid cooling:

Our customers require superior corrosion protection as well as efficient heat removal. These have been key drivers for our R&D teams during the development of these innovations.
In addition to the heat removal requirements, our liquid cooling products offer freeze protection of temperatures as low as -40°C (-40°F).
It is important for datacenters to quickly find the source of any leaks they may experience. Our solutions have been dyed fluorescent yellow to enable easy leak detection.

It is critical for customers to keep their systems running during testing and implementation. Our experts are there to support during the transition.

THE FUTURE OF TEMPERATURE MANAGEMENT IN DATA CENTERS

The migration from air cooling to liquid cooling is still in its infancy as many Data Centers are just now grappling with addressing the ever-increasing data loads on their servers. Additionally, these same companies are also facing societal pressures to reduce energy consumption and water usage. Thus, the need to move to a more efficient means of cooling becomes critical and innovative solutions such as direct-to-chip liquid cooling enabled by DOWFROST™ LC Heat Transfer Fluid can help meet those needs.

Dow has long been an industry leader within thermal management, providing high quality, long-lasting heat transfer fluids for nearly 90 years. We are committed to the continuous advancement of heat transfer-based technologies. Our heat transfer fluids are helping datacom companies around the globe achieve power usage effectiveness targets while taking on increasing heat loads.

Learn more about DOWFROST™ LC Inhibited Propylene Glycol-Based Heat Transfer Fluid

Link to the online article

Dow's sustainable packaging solutions enable Mengniu to launch all polyethylene yogurt pouch designed for recyclability in China

Brands join forces to empower the possibilities of closed-loop recycling.

Dow, a global materials science company, has partnered with Mengniu, a leading dairy company in China, to launch an all-polyethylene (PE) yogurt pouch designed for recyclability. This innovation strengthens both companies' commitment to achieving a circular economy in China.

Leveraging the materials science expertise of Dow and the collaboration across the value chain, Mengniu developed its first all-PE yogurt pouch designed for recyclability. Dow's INNATE™ TF-BOPE resins help ensure that packaging maintains its superior appearance and productiveness. The newly developed all-PE packaging enabled by INNATE™ TF-BOPE resins is a breakthrough for the dairy industry, as it enables traditional hard-to-recycle packaging to be integrated into closed-loop recycling streams through

responsible recycling and mechanical recycling technology, providing consumers with more choices of sustainable packaging.

“This partnership with Mengniu is a milestone for both brands to pioneer all-PE dairy packaging designed for recyclability in China. The country’s ambition to work towards Zero-waste Cities has changed how it tackles plastic waste. This collaboration is a significant step in facilitating recyclability and empowering the possibilities for recycled packaging to be transformed into high-value applications through responsible disposal and appropriate recycling process, reducing our industry’s reliance on unrenewable resources. Through our advanced research and development capabilities, we strive to help brand owners like Mengniu to take action and deliver on their sustainability commitments,” said **Bambang Candra, Asia Pacific commercial vice president of Dow Packaging and Specialty Plastics**.

Mengniu set a goal to achieve 100% technically recyclable packaging by 2025, striving to adopt low-carbon packaging in all product lines. Environmental-friendly manufacturing is an important pillar of Mengniu’s sustainability strategy, and adopting more sustainable packaging is one significant action to fulfil the commitment.

Mengniu's yogurt with this all-PE packaging designed for recyclability will be unveiled at the 2023 International Dairy Forum from Aug 4 to Aug 7 in Hohhot, a major city in Northern China, and will be available starting from supermarkets across the city.

Link to the online article

Dow Technology Wins 2023 ICIS Innovation Award

- Company recognized for Best Digital Innovation for a Large Company
- Two additional finalists in Best Product Category

A groundbreaking digital technology platform from Dow (NYSE: DOW) was recently honored with an ICIS Innovation Award, which recognizes companies who are paving the way in product, process, and sustainability innovations across the chemicals industry.

DOW™ Paint Vision has been chosen as a winner in the Best Digital Innovation category, which acknowledges transformative digital innovations that stand apart from the status quo. This category honors solutions and projects that are particularly effective in promoting digital

transformation and bringing about sustainable change. Two Dow technologies and products were also listed as finalists in the Best Product Innovation category in this year's contest.

In the coatings industry, the formulation of paints represents a multifaceted and technical procedure that demands significant time and resources. It requires users to combine raw materials in various combinations and test the resulting film performance, while also continually tweaking and testing to find a maximized balance of properties.

Built and backed by Dow scientists across the globe, DOW™ Paint Vision offers data-driven capabilities designed to simplify the formulation process and accelerate innovation. Through a personalized digital experience, DOW™ Paint Vision helps paint manufacturers facilitate virtual paint formulation with a suite of online tools, addressing market trends, pricing, and regulatory considerations, while helping to meet sustainability requirements to enable a safer world.

By leveraging artificial intelligence, modeling, and decades of materials science expertise in paint formulation, DOW™ Paint Vision revolutionizes the formulation process by providing the coatings industry with an innovative platform that helps formulators achieve performance targets faster and more efficiently across the coatings value chain.

"Paint Vision is Dow's first digital platform designed 100 percent by and for coatings formulators," said Tracy Young, global director for research & development and technical service & development for Dow Coating Materials. "Dow Paint Vision is a collaborative digital tool that allows us to deliver innovative formulated solutions to our customers, bringing data to create a competitive advantage in the coatings segment and optimize their business processes to serve their needs."

Finalists
Best Product Innovation from a Large Company – DEXCARE™ CD-1 Polymer is a deposition aid for sustainable beauty care. It is Dow's first dextran technology, which means it is derived from cane sugar via bio-fermentation, and delivers enhanced performance and resource efficiency.

Best Product Innovation from a Large Company – EcoSense™ GL-60 HA/HL Surfactants are novel bio-surfactants for personal care applications, aiming to meet the strong demand of more sustainable surfactants without sacrificing the performance. They are made from a green fermentation process, offering excellent mildness, cleansing, emulsifying and oils solubilization benefits.

Learn more about Dow's latest strides in Innovation, and award winning products and technology on dow.com.

Link to the online article

The Science of Golf: My Connection to the Greens and the Lab

By incorporating scientific knowledge into my golfing journey,
I have enhanced my performance competitively on the course
and developed a deeper appreciation for the intricacies of the game.

Beyond the serene greens and the satisfying sound of a well-struck ball, there lies a world of materials science and analytics connecting the scientific principles in my career to the strategies and techniques in my game.

As an Associate Research Scientist at Dow, I often find myself exploring the relationship between my two passions: science and golf.

Growing up, I was surrounded by innovators. My parents worked at Dow for 25 years as chemical engineers and my dad introduced me to the game of golf at an early age. Their constant support taught me I can achieve any goal I set: on the course and in the lab.

Every day I want to do better—to find solutions to challenges. My desire to improve provided me the opportunity to compete in both the 2022 & 2023 LPGA Dow Great Lakes Bay Invitational (GLBI) and to continue to work on solving some of the world's most pressing scientific and sustainability challenges.

Learning more about the intersection of science and golf has provided valuable insight into my golf experience and career.

For example: at Dow, we use the power of materials science to help make the GLBI tournament more circular, using recycled mesh as a raw material for tees, ball markers, and divot tools. As a golfer, I am excited that our polymers are used in a golf ball's core to enhance spin control and distance. By taking the challenges on the golf course and the needs of a golfer into our lab, we are contributing to optimizing an individual's experience on the golf course, truly connecting two of my biggest passions.

By incorporating scientific knowledge into my golfing journey, I have enhanced my performance competitively on the course and developed a deeper appreciation for the intricacies of the game.

So, the next time you step onto the green, or any other arena, consider what synergies you could find between your various passions.

Link to the online article