

# Designing films for a recyclable future

As packaging shifts towards mono-material structures and circular design, Kulbhushan Malik, global business head, Cosmo Films, explains how advances in films, coatings, and barrier technologies are helping brands meet sustainability goals without compromising on performance

**D**evelopments such as recyclable BOPP-based packaging, chemically recycled PCR films and PVC-free solutions are helping brands meet emerging regulatory expectations while maintaining functional performance. Kulbhushan Malik of Cosmo says balancing recyclability with barrier performance, shelf-life requirements and processing efficiency remains a challenge, making continuous R&D and collaboration across the packaging value chain essential.

**Rahul Kumar (RK): How are modern flexible substrates being engineered for coating compatibility?**

**Kulbhushan Malik (KM):** Modern flexible substrates are engineered through a combination of polymer formulation, surface energy control with inline corona, plasma or chemical surface treatments, and advanced coating compatible film structures. Manufacturers increasingly design BOPP, CPP, and BOPET films with optimised surface chemistry and uniform morphology to ensure compatibility across coating chemistries like water-based, solvent-based, and UV/LED curable systems.

Dedicated coated specialty films and label films are also developed to support multiple printing and coating technologies, including UV flexo, screen, and digital printing processes. Continuous R&D investments and testing infrastructure help ensure that these substrates deliver stable adhesion, uniform coating lay-down, and consistent performance during high-speed converting operations.

**RK: Why are surface treatments so important?**

**KM:** Surface treatment technologies play

a critical role in enhancing the surface energy of polymer films, which directly improves wetting, coating receptivity, and ink anchorage. Techniques such as corona treatment, plasma activation, and chemical priming modify the surface structure of films to create active bonding sites for coatings and inks. This ensures better adhesion, uniform coating spread, and long-term bond stability, particularly in demanding packaging and labelling applications where films undergo printing, lamination, and sealing processes. Consistent surface treatment also helps converters achieve reliable performance across high speed production lines.

**RK: How are film manufacturers reducing dependence on complex laminates?**

**KM:** Film manufacturers are increasingly integrating barrier functionality directly into film structures through advanced metallisation, coating technologies, and specialised film grades. Metallised films and coated barrier films are designed to provide resistance against oxygen, moisture, grease, and aroma migration, enabling simpler packaging structures while maintaining product protection and shelf life. The development of puncture resistant barrier metallised films, ultra high barrier metallised films replacing foil and functional coatings help replace multi layer laminates with more streamlined structures that are easier to recycle.

At the same time, innovation in specialty films supports the broader industry shift toward recyclable mono-material packaging solutions.

**RK: How do films perform under high-speed UV and LED curing?**

**KM:** Modern specialty films are engineered to withstand high-speed converting environments, including UV and LED curing systems used in advanced printing and coating applications. Improvements in film dimensional stability, thermal resistance, and polymer structure help prevent shrinkage, distortion, or heat related deformation during curing. Additionally, films are designed with optimised thickness profiles and controlled shrink properties to ensure smooth processing and consistent print registration even under high curing speeds. These advancements are particularly important for label films and high-performance decorative packaging applications.

**RK: How are your films aligned with design for recycling requirements?**

**KM:** Our films are manufactured by aligning the portfolios with design for recycling principles by focusing on mono-material structures, recyclable polymer systems, and sustainable barrier technologies. Developments such as recyclable BOPP-based packaging, chemically recycled PCR films, and PVC-free solutions are helping brands meet emerging regulatory expectations while maintaining functional performance. →



Kulbhushan Malik, Global Business Head, Cosmo Films



Malik: Balancing recyclability with performance, shelf-life, and processing efficiency remains a challenge

**RK: What remains the biggest challenge?**

**KM:** Balancing recyclability with barrier performance, shelf-life requirements, and processing efficiency remains a challenge, particularly in applications that traditionally relied on complex multi-material laminates. Continuous R&D and collaboration across the packaging value chain are therefore essential to achieve both performance and compliance with evolving regulations.

**RK: Are film manufacturers collaborating more closely with coating formulators?**

**KM:** Yes, collaboration between film manufacturers and coating formulators has increased significantly in recent years. As packaging and labelling applications demand more specialised functionalities, such as heat sealability, anti-fog performance, tactile finishes, and matt effects, film substrates are being co-developed with coatings to ensure optimal compatibility and performance. This collaborative approach helps accelerate innovation in functional packaging while ensuring that films perform reliably across coating, printing, and converting processes.

**RK: How are film surfaces being enhanced for premium print applications?**

**KM:** Film surfaces are enhanced through a combination of engineered coatings, controlled surface treatments, and specialised film structures designed for premium printability. Developments such as UV inkjet printable coated films, holographic lamination films, and matt coated synthetic paper enable high quality graphics, decorative effects, and superior ink anchorage.

These innovations help converters achieve consistent print performance across technologies such as flexography, digital printing, and screen printing while enabling brands to create visually distinctive packaging.

**RK: How do you balance innovation with cost competitiveness?**

**KM:** Balancing innovation with cost competitiveness requires a strong focus on operational efficiency, scale, and value-added product development. We have invested in high-speed film lines, cost-efficient production technologies, and optimised supply chains to reduce production costs while maintaining product performance. At the same time, expanding the portfolio of specialty and semi-specialty films enables to deliver differentiated functionality and improved margins, creating a sustainable balance between affordability and innovation.

**RK: How are manufacturers managing supply chain volatility?**

**KM:** Manufacturers are strengthening supply chain resilience through diversified sourcing, process optimisation, and strong quality assurance frameworks. Investments in modern manufacturing lines, advanced R&D infrastructure, and global production capabilities enable consistent product quality and reliable supply across markets. Maintaining strong relationships with global customers and operating across multiple product categories also helps reduce supply risks while ensuring continuity of delivery even in volatile market conditions.

**RK: What trends will shape flexible substrates over the next decade?**

**KM:** Over the next decade, the flexible substrate industry is expected to see strong growth in recyclable mono-material packaging, shift from PET/Alu/PE laminates to all PE or all PP structures, high performance specialty films in PP replacing PET and foil, and sustainable material innovations. Developments in synthetic paper, recyclable BOPP structures, barrier coated films, and PVC-free graphic solutions are likely to gain momentum as sustainability regulations tighten globally. At the same time, advances in functional coatings, digital printing compatibility, and high-performance decorative films will drive innovation in premium packaging and labelling applications. Strong push is expected towards ultra-thin high-performance films, bio-based and compostable films driven by carbon footprint reduction targets. The continued expansion of specialty films and sustainable packaging technologies will therefore shape the next phase of growth in the flexible substrates market. ■



Malik: Our innovations help converters achieve consistent print performance