

# Packaging

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Interview – Anantshree Chaturvedi, vice-chairman & CEO, Flex Films International

## It's a race for survival, not just for profits

Correspondent **Priyanka Tanwar** recently visited the UFlex offices in Noida for an interaction with **Anantshree Chaturvedi, vice-chairman & CEO, Flex Films International**. Chaturvedi holds a graduate degree from Babson College with a triple major in finance, global strategic management, and economics. He learned the trade of flexible packaging both in India and internationally with hands-on experience as a trainee and apprentice in India, Mexico, Poland, Egypt, the UAE, and the USA; and subsequently spearheaded the expansion of UFlex in the US. He is vested with the responsibility of global product stability, R&D, and HR protocols and dons the hat of the chief cultural officer at UFlex. Here, he speaks about sustainability, plastics, his company's future plans, and the industry in general.

**Packaging South Asia (PSA) – There is a lot of talk about plastic recycling and waste management. What's your take on the global plastic recycling initiatives?**

**Anantshree Chaturvedi** – There's a lot of talk and discussion on plastic recycling, in general. But is a real and practical solution being applied to solve the plastic crisis? I feel the world is still debating that. There are a couple of reasons for that. The biggest reason is that anything we need to do to solve the plastic crisis will require capital allocation. The stakeholders are waiting to see whether that comes via the government and regulations or if consumers, through their buying patterns and habits, force the industry to change and spend that capital. Either way, the solution will come. We know that the problem is unsustainable.

At UFlex, we have a Plastic Fix program – covered by *Packaging South Asia* before – that applies mechanical recycling, pyrolysis for energy, a biodegradable enzyme, and other various practical solutions. Some are waiting for a magic material to replace plastic. Or an alternative with the benefits of plastic but without its negative effects. Others are working on chemical recycling and other means. However, at UFlex, we are not staying quiet and applying whatever practical solutions are available.

I always have had this stand that plastic is a solvable problem. It just requires continued effort and commitment.

In 1992-93, when we were contemplating a large packaging plant, packaging consumption in India was around 2-3 kg per capita compared to more than 100 kg in developed nations such as the United States and Japan. We realized that when India starts substituting paper, tin, and glass with plastic packaging material, there will be a lot of waste. It would have been a huge challenge to manage that waste because our country had a rudimentary infrastructure for waste collection.

This is when we thought about building a packaging manufacturing plant that has zero solid waste discharge. We realized over a period that recycling itself is a self-sustaining business model with a reasonable ROI for sustenance. This was the vision of our group chairman and managing director Ashok Chaturvedi – that when India goes to 12-15 kg per capita consumption, we should not face a situation where we don't have the technology to recycle plastic waste.

**PSA – What strategies can packaging companies adopt to deal with plastic pollution?**

**Anantshree Chaturvedi** – Strategies, I would say, is a loaded word. A practical approach is – how does a company deal with its waste? Does a company have ways and means to deal with the waste it produces, and the plastic waste generated by a consumer after using its products?



*Anantshree Chaturvedi, vice-chairman & CEO, Flex Films International*

## FLEXIBLE PACKAGING

If you are making, let's say, flexible packaging or flexible packaging materials – do you have sustainable ways of dealing with the waste you create inside your facility? After the end consumer is done using your product, it generally enters the waste stream. How do you go from waste to wealth? How do you provide value to that product so that it comes back to you for recycling and reuse? Or can it go to a recycling facility that applies a rupee value to it?

If each company applies this approach – applying internal value as well as the external value after the end application – that is, I think, a very, very effective strategy.

But again, the approach would be very different if you are making, let's say, injection-molded products or other kinds of polymers than for someone who's making PET plastic bottles. It would be easy for the PET bottle maker to follow the plan because these bottles have a waste value – there is an established recycling stream for them.

### PSA – What are the recent developments in Flex Films concerning your sustainability initiatives?

**Anantshree Chaturvedi** – At UFlex, we have Project Plastic Fix and our initiatives under that bucket. We have scaled that initiative now. Initially, we started as a beta plant in India. Today, such facilities exist in Poland and Mexico. Similar facilities will come up in Egypt, Nigeria, and other places where we are producers.

We recycle post-consumer MLP mixed plastic waste into granules; upcycle recycled resins into PCR (post-consumer recycle) PET films, and partner with brand owners to create sustainable packaging solutions to reduce the use of virgin plastic at source. Our goal is to reach 1,00,000 tonnes of recycling by building additional recycling capacities across global locations.

We are in the phase of scaling the initiatives that work. We are in search of better enzymes, molecules, degradation, and compost technologies to add to this portfolio. We are at an advanced stage of development of enzyme-based biodegradable polymers, and this reaffirms the company's vision and focus on sustainable packaging. Enzyme-based technology breaks down uncollected flexible packaging waste into biomass in the soil under ambient conditions.

For us, the aim is clear. We need to break this inertia – in the market and the general polymer ecosystem – of not dealing with this problem. It is similar to how people don't want to deal with and accept climate change or infrastructure issues or food security and water security. Plastics is one of those things. It's easier to debate and talk. But the actual momentum on the ground is what's missing. UFlex is focused on how to break that lack of momentum and get things moving.

### PSA – Where do you see growth in the global and South Asian context for Flex Films?

**Anantshree Chaturvedi** – For Flex Films, I would say India is already a vast market for us. We have a new plant in Dharwad, Karnataka.

South Asia and Southeast Asia are excellent markets with a strong population that drives polymer, glass, and aluminum packaging. We've always been bullish on these markets. The key is how to balance growth with sustainability. You cannot have unsustainable growth. You cannot have a pure fossil fuel-based ecosystem that will provide non-future-proof products to these markets. That's always the challenge as these are typically low-price or low-cost markets. You will see further expansion not only by Flex Films but by other companies as well in this segment and in this space.

### PSA – Where are you planning these investments?

**Anantshree Chaturvedi** – We have expanded in Egypt and our Panipat facility. We have expanded CPP in India and Dubai. In Mexico, we have added a PCR facility recently. For us, one big part of our growth story right now for a different part of UFlex, is the aseptic packaging division or Asepto. That has gone from 7



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billion to 12 billion packs in the existing plant – 35% of that material gets exported to neighboring countries.

There's room to expand certain parts of our existing portfolio as well as our foray into PET chips to secure our raw material cycle, something we realized during Covid. There are several projects in play. We are in an expansion drive like everybody else. In the packaging film business in general, not just Flex Films, the market is in a deeply fragmented state at present. There are many new, small players and niche players. We will see this fragmented cycle transit into a consolidation cycle.

I do feel that in a year or a year-and-a-half, your journal will be reporting on mergers and acquisitions, takeover bids, and consolidations in this industry. I feel that a lot of inorganic growth as well as merger and acquisition-based growth will start happening as opposed to greenfield growth in this segment.

■ **PSA – What are some of your innovations in the flexible films division?**

**Anantshree Chaturvedi** – For us, it's all about adding barrier properties. Our metalized, high-barrier, easy-tear polyester has been a great innovation as well as our transparent, high-barrier, easy-tear one. But our focus today, if I may generalize, is to add the maximum number of properties to our existing films to provide a wide range of applications for different market segments to a product. All our products today are compatible with 100% PCR. So, there's no film in our portfolio that we can't convert into a 100% PCR film. That's been a big focus for us.

We have an ever-reaching goal of having the highest barrier property possible. We do it through a combination of applying coatings as well as making molecular and structural changes to our products so that we don't have many second or third manufacturing offline add-ons that add to the cost, complexity, and a closed delivery cycle. We think we can do it in line, or closer to in line – that's what Flex Films' focus is.

■ **PSA – Would you like to shed light on innovations in other departments?**

**Anantshree Chaturvedi** – If you take chemicals, for example, our focus has been on going away from PU-based inks and adhesives to going water-based. We have a goal of being completely water-based by 2025. That's been a key focus for us in that segment. It is the same with packaging. We want applications of sustainable films and technologies. We want to reduce our carbon footprint in the best way possible.

■ **PSA – Your expansion plans for the entire UFlex portfolio?**

**Anantshree Chaturvedi** – Our expansion plans are varied. If you look at our structure and our business, we want to be a material solution provider. In India, we're a packaging company. We have a wide array of products and services. And then, of course, there is an expansion of capacity and product portfolio. Eventually, we want to get into the cycle of being a material science, and a material solution provider to the industry.

■ **PSA – Anything you would like to add?**

**Anantshree Chaturvedi** – For companies in the polymers space, this is not just a race toward profitability, it is a race for survival. What most companies forget is that if we don't make this change today, and don't initiate these changes towards sustainability and a more carbon-neutral future, the industry's survival will be at stake. That's a key thing I think that gets forgotten.

The reason why UFlex invented these technologies and has been working on them since the early 90s was that we were worried about the future of our industry even back then. That's something we very actively pay attention to even today.

I feel many in the industry and a lot of machine and technology suppliers simply choose to blindfold themselves. A journal like yours can help highlight that a little bit, identify trends, and reinforce that change in the industry. ■



## Project Plastic Fix

UFlex runs a global sustainability initiative called Project Plastic Fix. The initiative is aligned with the company's sustainability approach of 4Rs to tackle the challenge of reducing stock and flow of plastic waste in the environment.

■ **The key principles are:**

- 1. Reduce** plastic at source by manufacturing and using films made from PCR. Flex Films offers a whole line of post-consumer grade PCR Films with up to 100% post-consumer recycled PET content under the brand name Asclepius.
- 2. Recycle** via upcycling and downcycling of MLP (Multi-Layer mixed Plastic) and PET containers, covers, other articles and bottles.
- 3. Reuse** as source substitution via Pyrolysis. In order to eliminate the need for energy-intensive machinery, UFlex converts the discarded plastic waste material generated daily by printing, unused trim, laminates, tubes, and other unprocessed materials at its Noida Packaging plant into liquid fuel, hydrocarbon gas, and carbon black.
- 4. Return** Flexzyme is an enzyme-based technology which, when it comes in contact with soil, completely breaks down uncollected flexible packaging waste into harmless elements such as water, biomass, and carbon.

## Sustainable and efficient flexible packaging

# Relative humidity in fast-curing solvent-free adhesives



India's largest multinational flexible packaging and solutions company UFlex has a strong focus on sustainability. Specializing in manufacturing and exporting packaging products it is committed to developing innovative and eco-friendly solutions in its chemicals business' diverse portfolio which includes packaging materials, water-based inks, coatings, and adhesives. In addition, it offers solvent-free adhesives, UV, UV LED, and EB inks and coatings. These products have gained recognition for their sustainability practices, ensuring both high quality and longevity.

Rajesh Srivastava

To meet the increasing consumer preferences in flexible packaging and their sustainability and cost reduction efforts, adhesive manufacturers have been compelled to innovate. The UFlex chemicals business has responded by offering solvent-free adhesives, which play a crucial role in providing converters with cost-reduction benefits and reducing volatile organic compound (VOC) emissions, while also enabling faster lamination speeds.

Among the key products offered by the chemicals business are solvent-free polyurethane laminating adhesives. These adhesives consist of 100% active components and do not require water or solvents as carriers. Primarily used in flexible packaging applications, they are available in various forms, including two-component adhesives composed of isocyanate and polyol, which react and form polyurethane. Additionally, we offer a one-component solvent-free adhesive based on NCO polyurethane, which reacts with humidity.

Solvent-free polyurethane laminating adhesives are applied to base substrates such as films or foils using solvent-less laminators, which can coat the adhesive via smooth roll transfer coating techniques. The coated substrates are then nipped and bonded to a secondary substrate to create the lamination. These laminations may contain multiple layers of laminate used to construct flexible packaging.

Flexible laminates in packaging are highly specialized products, combining several film/foil and paper layers with a variety of characteristics to achieve the desired features for

each individual package, such as snack food, hot fill, boil-in-bag, microwavable, and frozen food packaging. These laminates also comply with a wide range of FDA regulations.

UFlex's chemicals business continues to offer innovative and sustainable solutions that cater to the evolving needs of converters and packaging manufacturers. Its solvent-free polyurethane adhesive, known for its environmentally friendly properties, is specifically designed to provide several advantages enumerated below.

1. Versatility in the formulation – The adhesive can be formulated to meet specific adhesive performance requirements, including bond strengths, heat seal strength, and product resistance.
2. Operational safety and energy efficiency – The adhesive enables lower energy consumption during lamination, improving operational safety and energy efficiency.
3. Lower raw material cost – The adhesive offers cost savings through lower raw material costs compared to other types of adhesives.
4. Cost savings by eliminating ovens – Unlike water-based or solvent-based adhesives that require ovens to remove water or solvent carriers, the solvent-free adhesive eliminates this need, resulting in cost savings.
5. Faster machine speed – The adhesive allows faster machine speeds, making it more economical for converters and increasing productivity.
6. Improved Productivity – With its fast cure properties and longer pot life, the adhesive helps reduce lamination downtime, enabling converters to respond quickly and fulfil orders without compromising ap-



# SOLVENT FREE



UFlex offers solvent-free adhesives, coatings and varnishes.

pearance and performance.

7. Lower adhesive coat weight – The solvent-free adhesive can achieve the desired bond strength with a lower coat weight compared to solvent and water-based adhesives, reducing material usage.
8. No VOCs concern – Since the adhesive does not contain organic solvents, there is no need for explosion-proof or warming measures during production, transportation, storage, and use. Additionally, it eliminates harm to the health of the operators. There is also no need to build specific solvent storage warehousing.
9. The demand for fast-cure lamination adhesives with longer pot life is high among packaging converters as it increases efficiency and reduces lamination downtime.

However, despite the advantages mentioned, solvent-free polyurethane laminating adhesives also have certain limitations that hinder their broader success in the industry that are listed below.

1. Slow cure rate at lower temperatures – Solvent-free polyurethane laminating adhesives tend to have a slow cure rate at temperatures below 30°C, resulting in a low-to-zero green bond. This limitation makes it challenging to laminate and slit inline during production.
2. Poor adhesion with some laminations using water-based inks – Solvent-free adhesives may exhibit poor adhesion when used with laminations that involve water-based inks. This can impact the overall bond strength and reliability of the lamination.
3. Dissolving effect with ink – In certain cases, solventless polyurethane adhesives may experience the phenomenon of adhesive and ink phase dissolution, particularly with dye-based inks. This can compromise the integrity of the lamination and affect its overall performance.
4. Ultra-low migration of aromatic isocyanate in food applications – Solvent-free adhesives with aromatic isocyanates may have ultra-low migration levels in various food types, including fatty, aqueous, alcohol, and dry foods. However, in elevated temperature applications, migration concerns increase. As a result,

## TECHNICAL ARTICLE

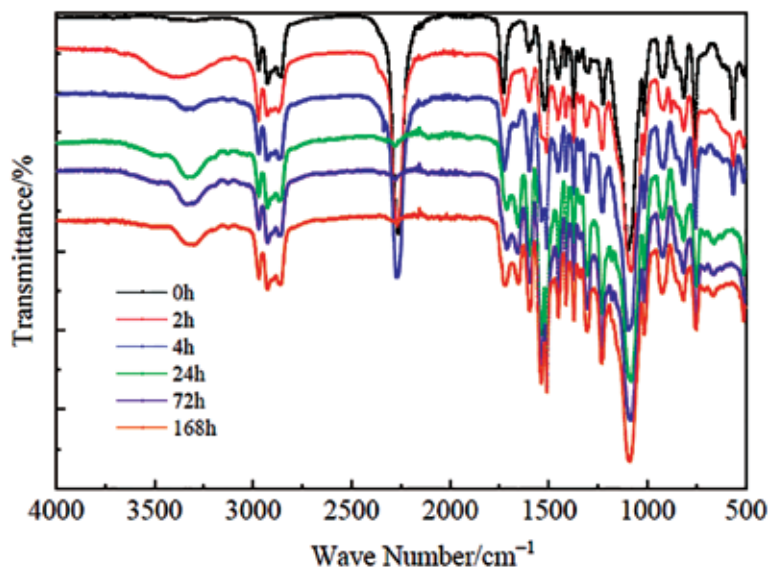
these adhesives often require a longer curing time to meet FDA compliance standards.

5. Short pot life – Solvent-free polyurethane adhesives typically have a short pot life, which refers to the time available for mixing and application before the adhesive starts to cure. The short pot life can limit the operational time and efficiency during the lamination process.
6. Curing aspect – The curing process of solventless film-laminating adhesives is influenced by temperature and humidity conditions. Higher ambient temperatures accelerate the functional group reactions, resulting in a shorter pot life. On the other hand, higher humidity levels accelerate the curing reaction rate and may lead to volume expansion of the adhesive due to the release of carbon dioxide (CO<sub>2</sub>).

Monitoring the curing progress of solvent-free adhesives can be done using techniques like Fourier Transform Infrared Spectroscopy (FTIR). FTIR analysis can provide insights into the reaction progress over time by examining the NCO groups and the formation of urethane linkages. The weakening of NCO groups and the appearance of C=O stretching vibrations from the urethane linkages can indicate the progress of the curing reaction. The reaction speed may slow down after 72 hours as some unreacted NCO groups become encapsulated within the adhesive system, hindering further contact between NCO groups and OH/water

In our laboratory study, we investigated the impact of temperature and humidity on the curing behavior of a two-component polyurethane adhesive. The objective was to examine the effects of the environment on bond strength, toughness, failure displacement, joint stiffness, and failure mode. The study was conducted under various temperature and humidity conditions, including -20°C/12%Rh, -10°C/20%Rh, -10°C/30%Rh, and 25°C/45%Rh.

### Infrared spectrum of PU adhesive at different curing times



The results of the study revealed interesting findings. As the humidity increased from 12% to 45%, there was a linear decrease in bond strength. This indicates that higher humidity levels negatively affect the bond strength of the adhesive. On the other hand, increasing the temperature from -20°C to 25°C resulted in a reduction in curing time and an increase in bond strength. Higher temperatures accelerated the curing process and improved the strength of the bond.

It is important to note that the effects of temperature and humidity can vary depending on the specific type of adhesive being used. Different adhesives may exhibit different responses to changes in environmental conditions. Most literature references standard conditions of 25°C and 50% relative humidity for adhesive application, which aligns with the findings of our study as shown in Table 1.

Understanding the influence of temperature and humidity on adhesive performance is crucial for optimizing the application process and ensuring the desired bond strength and reliability. By considering these factors, manufacturers can make informed decisions regarding the selection and use of polyurethane adhesives in different environmental conditions.

**Table 1: Effect of humidity and temperature in polyurethane systems**

Conditions	Higher temperature	Lower temperature	Higher humidity	Lower humidity
Cure type				
Chemical Cure- Two component	Reduces cure time	Increases cure time	Little effect	Affects
Chemical Cure- One component	Reduces cure time	Increases cure time	Reduces cure time	Increases cure time

Source: UFlex Chemical Division

## Regulation information

Food safety is of utmost importance in the context of food packaging, and it requires special attention and adherence to stringent regulatory requirements. Adhesives, being an integral part of the packaging, need to be carefully produced to ensure full compliance with safety and regulatory standards. This involves careful selection of raw materials and meticulous formulation design to meet the required legislation for food safety.

The US Food and Drug Administration (FDA) regulates the use of adhesives in food packaging, and their approach differs somewhat from how they regulate other food contact substances. While FDA regulations for indirect food additives typically focus on the food contact substance itself, the requirements specified for adhesives place more responsibility on the manufacturers of food packaging containing adhesives and the manufacturers of the finished food product.

Under Title 21 of the Code of Federal Regulations (C.F.R.) Section 175.105, the FDA clears the use of various substances that may be employed in adhesive formulations intended for packaging, transporting, or holding food. As

such, manufacturers of adhesive formulations can utilize any substance listed under Section 175.105(c) in their formulations, subject to any limitations specified for the use of those substances in the regulation.

The macromolecular structure of adhesives is formed through the chemical reaction of monomers. Both monomers and oligomers have the potential to migrate from packaging materials into food. When the amount of unreacted monomers or low-molecular-weight substances in food reaches a certain limit and is absorbed by the human body, serious health risks may arise (EU 10/2011). The toxicity level of these compounds depends on the fractional concentration of unreacted monomers. Isocyanates used in polyurethane polymers and adhesives carry a low risk of oral toxicity but a high risk of toxicity through dermal or inhalation exposure.

An example of newly formed Non-Intentionally Added Substances (NIAS) is Poly Aromatic Amines (PAAs) in polyurethane (PU) adhesives. PU adhesives are formed through the polymerization of polyols and diisocyanate monomers. If the adhesive has not been properly cured or if the ingredients have not been adequately mixed, the polymerization reaction may not be efficient enough, and any remaining non-polymerized aromatic isocyanates can react with moisture, resulting in the production of PAAs. In addition to PAAs, other NIAS can also be formed from laminating adhesives.

Overall, ensuring food safety requires strict adherence to regulations, careful formulation design, and proper curing processes to minimize the migration of harmful substances from adhesives into food.

## UFlex solvent-free adhesives comply with the following compliances/global regulations:

- European Union (10/2011)
- EUPIA /CEPE
- REACH (1907/2006)
- REACH (SVHC's)
- Swiss Ordinance on Materials and Articles SR 817.023.21
- FDA (21 CFR 175.105)
- Heavy Metals (CONEG)
- EC-standard safety of toys (EN-71 part -3)
- EC-Directive 94/62/EEC
- Latex and Natural Rubber with allergenic potential
- Mineral Oil Hydrocarbons [MOH] (C16 to C24)
- Benzophenones
- Phthalates
- Bisphenol-A Compounds
- Indian Standard - Food Safety and Standards (Packaging) Regulations – 2018 [Gazette Notification dated 24.12.2018, F. No 1-95/Std./Packaging/SP(L&C/A)/FSSAI-2017]
- Food Allergen

## UFlex Chemicals

UFlex Limited's chemicals business, established in 1994 and headquartered in Noida, is a global provider of flexible packaging inks, water-based adhesives, solvent-less adhesives, solvent-based adhesives, and specialty UV and LED coatings. It offers a comprehensive range of UV and LED





inks and coatings for sheetfed offset, letterpress, and narrow web applications.

As a leading ink manufacturer, the company prioritizes research and development, and its state-of-the-art R&D centre is NABL (ISO/IEC 17025:2017) accredited and recognized by the Department of Science and Technology, Government of India. Certifications for its Noida and Jammu plants, include ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, ISO 50001:2018, and

ISO 31000:2018, demonstrating commitment to quality, environmental responsibility, occupational health and safety, energy management, and risk management.

The primary focus is on developing sustainable technologies, offering customized products, and providing food-safe, toluene-free compliant inks in accordance with IS 15495:2020 standards. It also provides on-site support to ensure optimal performance and customer satisfaction. ■



Rajesh Srivastava is the senior vice president of the Chemicals Business of UFlex

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