

Innovative solutions for sustainable paper packaging



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Abstract

The demand of Packaging board and paper is growing rapidly over conventional grades of paper. Growing environment concern is also one of the main driving factors. The usage of single-use plastic (or plastic containing) packaging is being discouraged by various means. In India many states are discouraging the usage of plastic packaging even by laws now.

Further there is a growing need of paper recycling which puts up challenges to paper mills producing packaging grades of paper in terms of food contact compliances (for short and long-time packaging) as well as on other functional parameters. This challenge is felt most by mill using recycled paper compared to mills using virgin pulp.

We at BASF are working in the same direction to overcome these challenges. The available innovative solutions for sustainable packaging are designed to overcome the current challenges in terms of production of packaging grades of paper as well as environmental challenges.

Introduction

This paper talks about challenges faced by various segments of packaging paper. The available solution as well as solutions in R&D pipeline will also be discussed in brief along with examples of case studies.

Polyethylene (PE) coated paper has been widely used for various packaging applications such as fast food packaging applications to protect packaging from damage with oil and grease from food stuffs. Although PE coated paper has many benefits such as good oil and grease resistance and relatively low cost to produce, it is known that recyclability or repulpability of PE coated paper is not sufficient due to hydrophobic nature of polyethylene.

Recently 'Sustainable' packaging system become higher attention due to various environmental concerns such as global warming by carbon dioxide emission, VOC issue and resource shortage, it is also become more stringent regulations by governments are enforced in many countries. BASF worked with paper makers, formulators and converters to develop innovative water-based acrylic dispersions to replace PE extrusion.

Purpose for packaging:

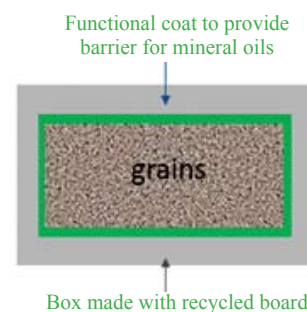
Below mentioned objectives are well recognized objectives of packaging

- ★ For barrier (from gas, moisture, contaminants, oil etc)
- ★ For information transmission (medicine boxes)
- ★ For Market Communication
- ★ For convenience of handling, transporting and distribution
- ★ For Security (tampering proof)
- ★ For physical protection of enclosed material (mechanical shock, vibrations etc)

In this paper we will put more focus on the first aspect of paper packaging ie Barrier

Mineral oil barrier:

Cutting of metals into different shapes and sizes as per the requirement of the machine is done using frame cutting and to join different parts of machinery drilling which are required for the regulation of machine includes temperature control box, ceramic band heaters, hear box, etc. also, the functioning of feeding is highly improved due to the spiral barrel with a longitudinal groove.



Eco friendly coating solution are designed for variety of application from paper mill to converting units.

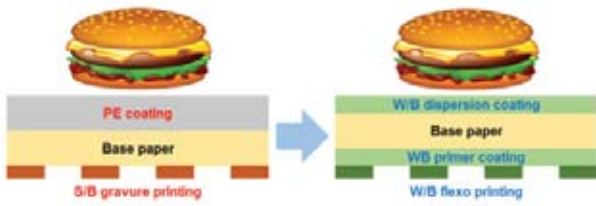
Oil & Grease Resistance:

The end use refers to the packaging needs a QSR (quick service restaurant) for example lower GSM burger wrapper to folding box board for burgers, popcorn etc. Generally, PE coated paper/board is used for these applications.

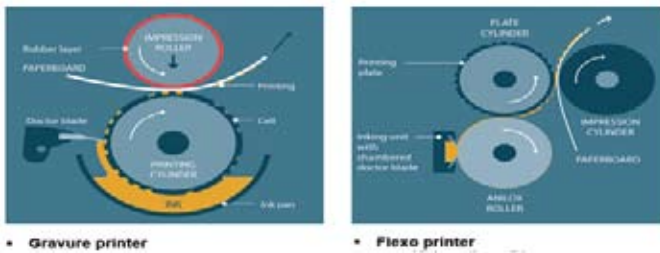


Core-shell type water-based dispersion are found to be quite suitable to replace PE for such packaging needs where oil resistance is the main parameter.

Example 1: Commercial case for burger wrapper:



Benefits	PE coated wrapper	Dispersion coated wrapper
Cost saving	10 gsm of PE coating	3-4 gsm of dispersion coating
Recyclability	Difficult to recycle, Not compostable	Easy to recycle, More compostable than PE
Tasty burger	Soggy bun by poor permeability	Not soggy bun by good permeability
Eco-friendly ink	Solvent based gravure ink	Water based flexo ink



The above example is for a burger wrapper of 35 gsm. The existing structure was with 10 gsm of PE. With core shell water based dispersion the PE was eliminated and 3-4 gsm of new coating using converting set up of gravure and flexo. Apart from PE replacement, the new permeable coating avoided the sogginess in bun by avoiding the steam condensation.

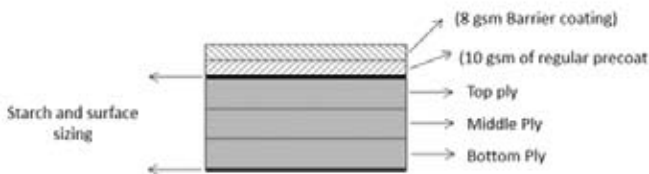
Example 2: Commercial case for recycled board on paper machine run

The target for this application was to develop oil resistance (Kit 8) and some water repellency. The end use was for paper plates.

Below is the application system:



Below is the structure of the final board:



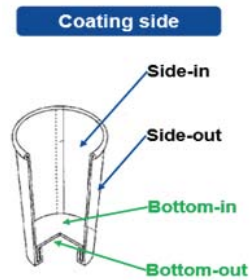
Relevant barrier properties were achieved in above commercial example. Below is a comparison of repulpability of PE paper vs samples from above cases:



Its evident from above that the recyclability is really good with the water based barrier coating while other functional properties are achieved.

Paper Cups:

Generally, there are two applications of hot and cold beverages. Normally it is with PE. The key parameters needed are liquid repellency and very good seal strength (especially with hot liquids like coffee). There is gradually a shift to biodegradable/compostable plastic and water-based barrier coating chemicals. Below photo further explains the structure of a paper cup:



Cold cup

- Structural characteristic**
 - Condensation occur easily on out of the side wall
 - Need to coat Side-out too
- Coatings**
 - Side-in & Bottom-in: Double coating
 - Side-out & Bottom-out: Single coating

Hot cup

- Structural characteristic**
 - No need to coat for Side-out
 - Need vapor barrier for Bottom side
- Coatings**
 - Side-in & Bottom-in: Double coating
 - Bottom-out: Single coating

The paper cup application with water-based dispersion is in advanced stage of development with commercial trials happening at off-machine coater and converter level. The cup forming trials are also quiet encouraging.

Conclusion:

- ★ The innovative chemistry of water-based core-shell dispersion is a solution to growing challenges posted by ban of plastic usage.
- ★ The final products treated with above chemistry complies to the stricter direct food contact laws (FDA/BFR/GB).'
- ★ For good economy of operations these chemistries are opening venues of creating barrier effects within the paper mill site, ie – using existing paper coating equipments.
- ★ Since the final paper packaging structure is recyclable, it helps in reducing the carbon foot print.