



PRODUCT APPLICATION NOTE
**Metal adhesion promoter for
vacuum metallized CPP films**

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The packaging industry has been propelled to astonishing heights since the creation of flexible films. Continual innovations in the utilization of these films through manufacturing practices progressed the need of a broad spectrum of products best suited to further enhance their desirable characteristics.

While there are many polymers utilized in the flexible packaging industry, the most common are polypropylene (PP), polyethylene (PE), polyvinyl chloride (PVC), polyethylene terephthalate (PET). One of the most popular innovations that have taken place in the recent past is the introduction of metallized films in the flexible packaging industry. With the deposition under vacuum, of an extremely thin layer of aluminum vapors on a polymer's surface, the finished product proves to be more resistant to both water and oxygen transmission as well as providing a metallic and glossy appearance—much like that of aluminum foil. The ability to provide some of the key properties possessed by aluminum foil, for a considerably lower cost and tare weight makes metallized films a popular choice in the food and confectionary fields.

Polyester and PP films are the most used substrates for producing these high barrier packaging films- Metallized Films. Cast PP film is fast catching up as the substrate of choice for metallization by packaging industry. Vacuum metallized cast PP film is known as VMCPP or simply MCPP in the trade. Areas of applications include food packaging, cosmetic packaging, tobacco & liquor packaging, besides numerous decorative applications.



Barrier properties of MCPP films depends on the quality of metal adhesion on the film surface, which in turn, is dependent on:

1. Film surface energy.
2. Interaction of the metal with the surface.
3. Metal structure build-up beyond the surface.
4. Thickness of the metal deposited.

The extent of metal adhesion on CPP surface is important to provide a good quality of film and ensure the desired shelf life of the product packed with it. Unlike polyester, PP has a very low surface energy level that results in relatively lower adhesion of the aluminium particles on PP film surface. Corona treatment provides the basic modification to enhance surface energy. To augment surface energy further or make up for the drop in surface energy or Dyne Level, in common parlance, additional in-line corona treatment or plasma treatment

facility is provided immediately before metallization. These measures undoubtedly improve metal adhesion on PP films but have a limitation.

Too much of high voltage electric discharge tends to cause a drop in mechanical properties, degradation of the surface polymer and possibly undesirable treatment on the reverse side of the film. Increase in surface roughness of the film by using additives like antiblock agents also helps in improving metal anchorage on PP film surface. However, beyond a limit such additives may affect haze and gloss adversely.

Metal adhesion can be uniformly and decisively enhanced by using a polymer in the surface layer of PP film that has inherently high polarity and suitable physical characteristics for this purpose. This renders the target film surface better receptive to the metal vapours hitting and adhering to it.

BindEX E-183 and BindEX E-189 are such a polymeric modifier from Pluss Advanced Technologies. Its physical characteristics allow the approaching metal vapours to embed strongly into the film surface layer. The polar groups contained in it provide a chemical affinity towards the metal particles, making a strong bond. Its uniform distribution in the film surface layer imparts an equally uniform polarity to the film surface. This, in turn, ensures consistent metal bonding values throughout the metalized area.

CHARACTERISTICS OF BindEX E-183 & BindEX E-189

BindEX E-183 and BindEX E-189 are a maleic anhydride modified, very low-density polyolefin adhesive resin, having excellent compatibility with polyethylenes, polypropylenes and copolymers. It is used as a metal adhesion improver in vacuum metalized cast polypropylene films. Depending on the extent of metal adhesion desired, 10-30% of BindEX E-183 and BindEX E-189 can be mixed with PP random copolymer to constitute skin layer of the coextruded CPP structure.

Maleic anhydride groups grafted on the polymer chains present in BindEX E-183 and E-189 provide a permanently polar uniform coating on the surface layer of coextruded film. This forms a receptive layer for aluminum vapours, to physically & chemically bond with it. The polymer base of these grades is soft enough to let the first layer of aluminum particles get embedded into the surface layer of the film. This ensures a better adhesion of subsequent vapours deposited in high OD metallized films required for good barrier to oxygen, moisture, and light.


Corona or plasma treatment of the film surface further enhances metal adhesion. At the same time, presence of these grades reduces performance uncertainty due to natural decay of these physical treatments.

BindEX E-183 has a low grafting level while BindEX E-189 has medium grafting level.

Usage Recommendations:

Given below is a typical cast PP three-layer film configuration for metallization.

Layer Type	Layer Ratio	Suggested Formulation
Sealing Layer	20%	TerPP (92%) + Antiblock (8%)
Core Layer	60%	HomoPP (100%)
Treated Layer	20%	CoPP (65-87%) + BindEX E-183 or BindEX E-189(10-30%) + Antiblock (3-5%)



Concentration of BindEX E-183 and BindEX E-189 in the skin layer for metallization depends on metal bond strength requirement for a given application. It is bendable with homo- & co-polymer PP used normally for CPP, without affecting optical properties and the blend is extrudable similarly.

The Maximum processing temperature should not exceed 290 °C. The film should be corona treated in-line to a 40-45 dynes / cm level.

To minimize decay in the corona treatment level during storage prior to metallization, the film rolls should be well protected from environmental contamination and high ambient temperatures. Shrink-wrapping the rolls and storing them under controlled low temperature and humidity conditions goes a long way in retaining the surface properties for good metallization. Plasma treatment in-line with metallization enhances performance further.

At addition levels of 5-10 % in skin layer, metal bond of 50-100 g/15 mm have been reported. At higher levels of 20-30 %, metal bond strength of 300-600 g/15mm have been obtained, as measured on the laminate made with reverse printed BOPP film.

Additionally, we can suggest that -

1. Completely clean the breaker plate and filter area to get rid of any contamination or gel particles.
2. Add a fine mesh layer for extra filtering.
3. Perform a comprehensive cleaning of the screw to remove any material buildup or impurities that could interfere with the production process and affect the final product quality.

Storage

BindEX E-183 and BindEX E-189 should be stored in a dry, cool, and well-ventilated area protected from UV light. Improper storage conditions may cause degradation and thus can adversely affect the physical properties of the product and thereby its performance.

Disclaimer:

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