

An Introduction to Window Film Technology

The comment “Window film is simply a sticky plastic” might have been true thirty years ago, but contradicts and misunderstands the complex and demanding technology, high quality, high performance materials that are used in modern window films. Let’s take a look at some of the technologies used in today’s advanced window films.

Window Film Technology – Components

The performance and durability of the window film selected is determined by the types and quality of the components and construction used. The essential components include:

- Protective Release Liner – a film, usually polyester, which is used to cover the adhesive and protect it from contamination before installation
- Adhesive – high quality, low or zero distortion adhesives that adheres the polyester film to glass; types used for automotive installations retain high adhesion even on double curved glass
- Polyester Film – a strong, high clarity, high quality plastic film – more than one layer may be used with a laminating adhesive to produce a multi-layered structure
- Scratch Resistant Coating – a hard acrylic coating that provides protection for the polyester against scratching and abrasion
- Dyes, metals, alloys and UV inhibitors are added to produce the specific properties desired

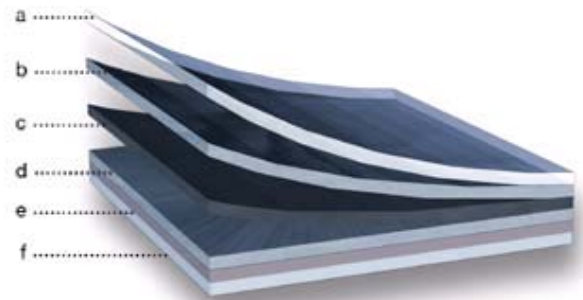


Figure 1: Structure of a typical window film
a = release liner with silicone coating; b = adhesive layer with UV inhibitor; c = clear or tinted polyester film; d = adhesive layer; e = metallised layer for heat rejection on clear polyester film; f = scratch-resistant coating. Layer c may have added UV inhibitors for extended durability

All components must have high optical quality to allow undistorted vision through the glass + film. Figure 1 shows a standard window film – this has eight layers and has had at least seven manufacturing processes; quality control of raw materials, manufacture and end product adds further to these processes.

Window Film Technology – Manufacturing Processes

Manufacturing processes, each requiring care to ensure the highest quality is obtained, include:



Figure 2: Coating and lamination of two polyester films in a clean room during window film manufacture

Coating: Material is transferred from a container onto a large roller, then from the roller onto the surface of polyester film. Examples include scratch resistant surfaces and adhesives.

Laminating: A film coated with adhesive is adhered to a second uncoated film, using a roller system to press the two films together.

Metallising: A roll of polyester film is wound round a water-cooled roller in a large metal chamber, and the air is pumped out to produce a vacuum. Metal – usually Aluminium – is evaporated onto the cold surface of the film; very few metals evaporate in a vacuum so sputtering is used for other metals. Metallising is a fast process compared to sputtering.

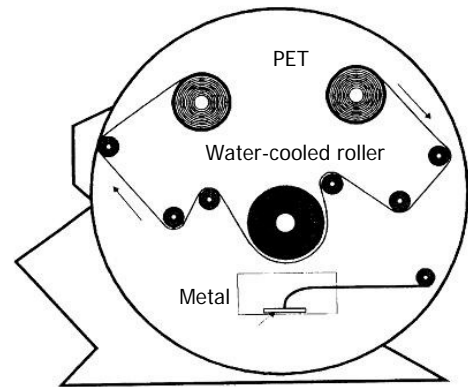


Figure 3: Metallising of polyester (PET) film

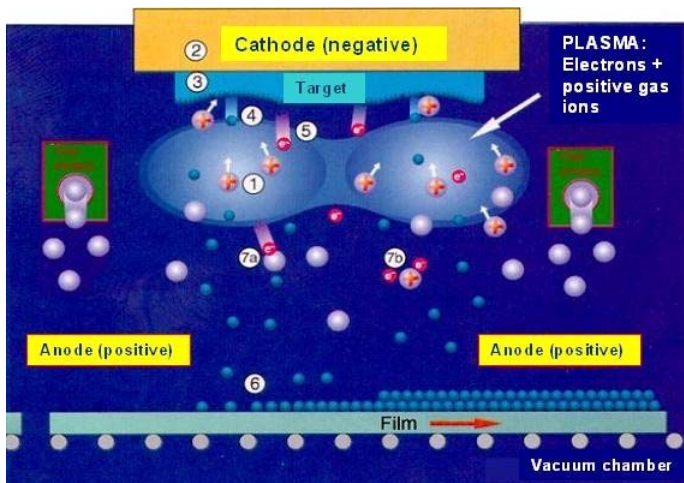


Figure 4: Sputtering of polyester (PET) film

Sputtering: Equipment very similar to metallising is used, but a metal or alloy target is bombarded with positive ions to knock (sputter) atoms of metal out of the target and onto the cold film surface. A large number of different metals and alloys can be sputtered. Metals used in sputtering, such as Nickel, can also have extra resistance to corrosion.

Colouring: Colours may be added to the adhesive before coating onto the polyester (as above) or the polyester film may be deep dyed. The colour produced is usually a mixture of different dyes; in general, better durability is obtained using deep dyeing processes.



Figure 5: Deep dyeing of polyester film – the finished film must be a high clarity, low distortion product

Window Film Technology, or “What You See Is What You Get”

Whether a window film is used to reduce solar heat gain, improve safety and security, produce ‘one way mirrors’, or to reduce fading, it is essential that high quality is always provided to the customer. This quality objective requires strict quality control of the raw materials, manufacturing processes, final product, packaging and warehousing. The number and types of tests used to verify that the window film product is fit for purpose are at least equal to that of other, more traditional industries. In fact, quality control has to be even stricter compared to some industries because window film will be used as part of the glass/glazing. The human eye can see defects as small as 25 microns (0.025 mm or 0.001 inches), so optical quality is essential for an unobstructed view through the

glass + film. “What You See Is What You Get” for high quality, durable, high performance window film should always be a reality for every customer.