

PVD + UV varnishes

An alternative to Chrome Plating

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Overview



- * Traditional Chrome Plating
- * Chrome Alternatives
- * Existing PVD Markets
- * UV Coatings & PVD Processes
- * Advantages of PVD Coating Technology
- * Finishing

Chrome Plating



- * Hard Chrome Plating
 - Metal Substrates
 - Chrome Thickness > 1 mil
 - Applications include hydraulic cylinder rods, piston rings, thread guides, gun bores

- * Decorative Chrome Plating
 - Plastic Substrates: only ABS for galvanic application
 - Chrome Thickness 250 Å – 1000 Å
 - Applications include automotive interior & exterior, appliances, general purpose applications.

Basic Chrome Plating



- * Polishing / Buffing
- * Cleaning / Acid Dipping
- * Copper Plating
- * Repeat Steps
- * Nickel Plating
- * Rinse
- * Repeat Steps
- * Chrome Plating
- * Rinse
- * Repeat steps

Process Cycle Time: > 2 hrs

Negatives of Chrome Plating



- * Environmentally Hazardous
- * Heavily Regulated - Costly
- * Extreme Health Hazard
- * Quality Problems
- * Safety Issues For Some Component Parts
- * Reduction in Mechanical Properties For Some Component Parts
- * Limited Design Capabilities

New Applications and Development on Polymers



- * Performance of polymers are constantly improving and therefore fields of applications are quickly increasing.
- * This means requests for new compatible process in order to obtain finishing “like” those that were previously achieved with metals and also brand-new finishes.

Decorative PVD Process



To achieve higher performance and follow an economical industrial criteria, the deposition rate needs to be faster and it generates temperature in the coating chamber: the plastic substrate can therefore suffer from a **thermal shock**.

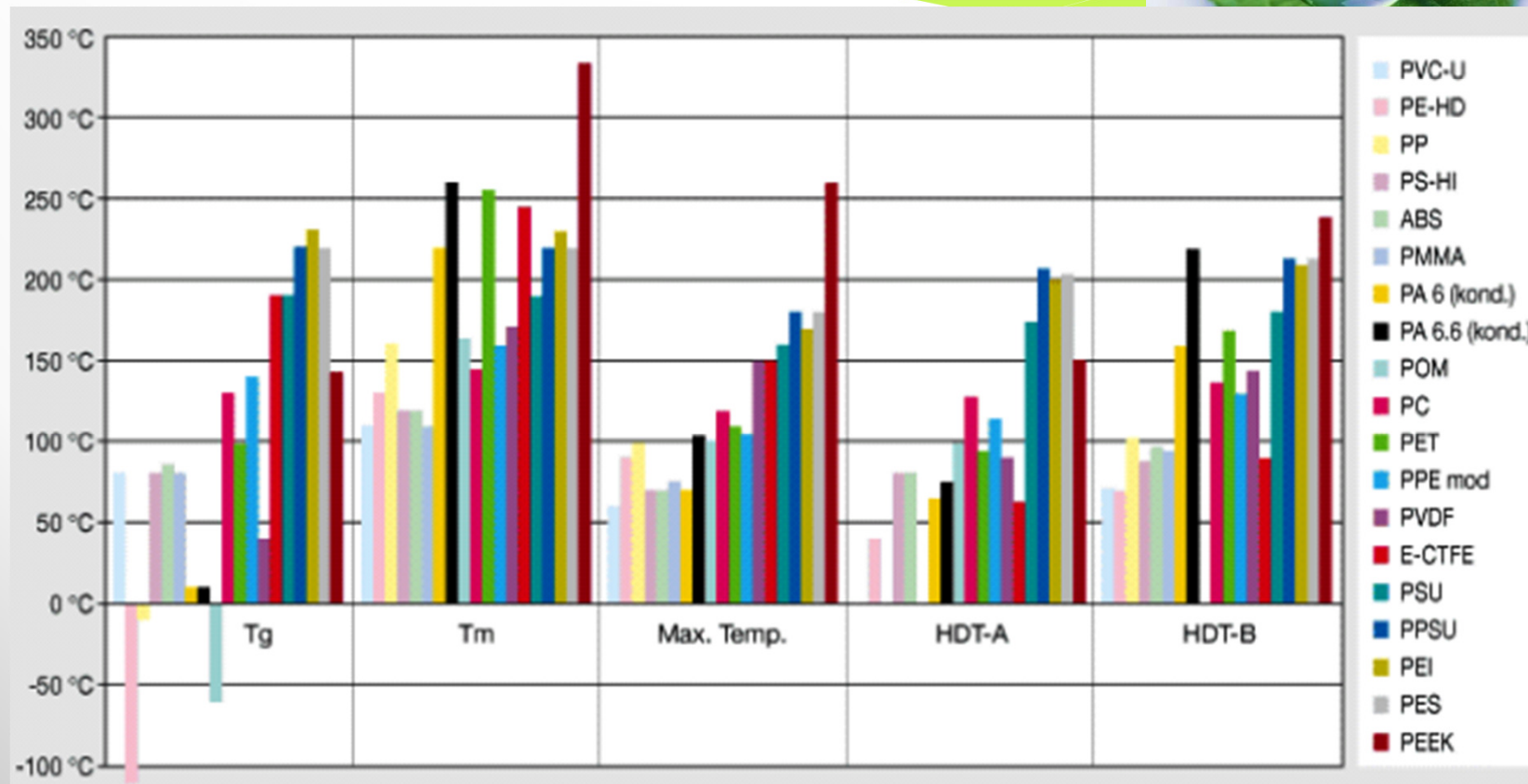
When plastic is not enough performing for PVD deposition, it is possible to improve its hardness and brightness applying a **UV** varnish base-coat.

Polymers Hardness

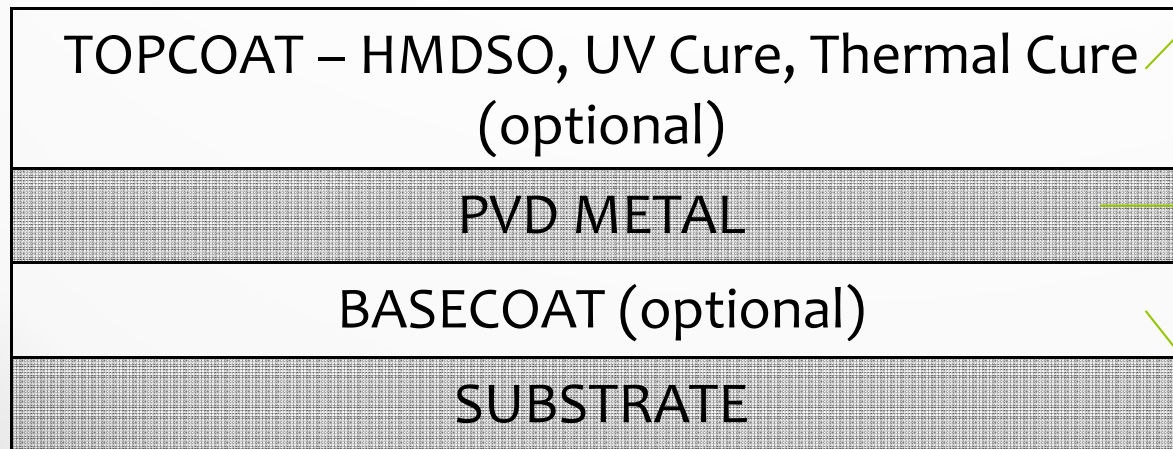


Polymer	Rockwell		Shore	indention hardness [MPa]	
	M	R		H358/30	H961/30
PEEK	99	126			169
PEEK-GL30	103	124			227
PEEK-CA30	107	124			246
PEEK-FC30					175
PEK		108			178
PPS-GL40			D91		{310}
PEI	109			140	
PEI-GL30	114			165	
PES				152	
PES-GL30				217	221
PSU	69			140	
PSU-GL30		124			202
LCP	60-100				
LCP-GL30	80-100				
PPA-GL33		125			
PI (Aurum)	95	129			
PI-GL30	104	128			

Temperature of Poly



Decorative PVD Process



Provides protection of the metal layer and performance properties

Any metals or alloys:
Stainless Steel, Chrome,
Titanium, Copper, Brass,
Silver...

Seals substrate, provides smooth surface and adhesion properties

Basic UV Cure + PVD Process



- * Basecoat Application
- * Ambient or Heated Flash
- * UV Cure
- * PVD Application
- * Topcoat Application
- * Ambient or Heated Flash
- * UV Cure

Process Cycle Time: < 20 minutes

PVD Applications



- * Automotive – interior and exterior
- * Household appliances
- * Cosmetics
- * Lighting
- * Furniture and Home Interior Applications
- * Fashion items
- * Lighting and Optical Applications

Finishing



Examples of cycles



* Automotive Lighting

- UV Basecoat/ Aluminum/ UV Topcoat
- UV Basecoat/ Aluminum/ HMDSO
- UV Basecoat/ Aluminum/ HMDSO/ Tinted Topcoat
- Direct Metalization Aluminum/ HMDSO

* Alloy Wheels

- Thermal Cure Powder/ Chrome / Thermal Cure Powder or Liquid

Advantages of PVD

* PVD

- Environmentally Friendly
- Uniform deposition
- Low temperature
- Repeatable
- Adjustable thickness (full covered or semi-transparent)
- Multilayers
- No Hexavalent Chrome
- Elimination of Chemical Disposal
- Reduced Steps In Process
- Reduced Cycle Time
- Smaller Footprint
- Minimizes need to outsource



Advantages of UV Cure



* UV Cure

- High Solids, Low Volatile Organic Compound
- Quick Cycle Time, Increased Productivity
 - Reduced Scrap due to shorter “wet” time
- Low Energy Consumption
- Small Footprint, Reduced Floor Space
- Increased Performance, Higher Crosslink Density
 - Scratch & Abrasion Resistance, Chemical Resistance, Corrosion Resistance, etc.

Advantages of UV Cure + PVD



- * Process of UV Cure + PVD
 - Increases Quality Control
 - Increased Part Design Flexibility
 - Functional Design Capabilities
 - Transparency, RF Transparency, EMI Shielding
 - Wide Range of Appearances
 - Color Selection, Gloss Selection
 - Capable on Larger Variety of Substrates
 - Improved Safety
 - No change to break strength, no splintering, no sharp edges
 - Cost Advantage

Critical to Success Factors



- * Performance Requirements
 - Moisture Resistance
 - Temperature Shock Resistance
 - Chemical Resistance
 - Corrosion Resistance
 - Impact Resistance
 - Scratch and Abrasion Resistance
 - Weathering Resistance

Critical to Success Factors



- * Process Controls
 - Molding
 - Part Orientation, Carrier and Transfer
 - Coating
 - Application – Coverage and Film Build Controls
 - Process – Flash Times and UV Cure Dosage
 - PVD
 - Part Orientation and Fixture Motion
 - Set Points and Cycle Time
 - System Maintenance

Conclusion



- * • UV & PVD is safer and more environmentally friendly than chrome plating.
- * • UV & PVD is more process friendly, requiring less steps than chrome plating.
- * • UV & PVD coatings can meet the OEMs toughest requirements.
- * • PVD allows designers to have more flexibility and more choices when designing the products.



THANK YOU

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