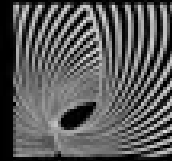


VACUUM COATING TECHNOLOGIES



Kolzer



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16th of June 2009

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Institute of Physics - London



Sputtering on Polymers – Industrial Applications

Institute of Physics - London 16th June 2009

- **Introduction to Kolzer**
- **What is Sputtering**
- **The Plasma Role**
- **Development on Polymers**
- **Sputtering and Polymers**
- **Case Histories**
- **Sputtering Vs. Electroplating**
- **Future Applications**

History

- **1950 Kolzer HVI: start manufacturing simple industrial vacuum systems**
- **1952 Kolzer projected and manufactured first high vacuum metallizing plant**
- **2009: 57 years of research and manufacture have led to strong know-how and more than 1'000 plants working around the world**



KOLZER project and manufacture Vacuum Plant

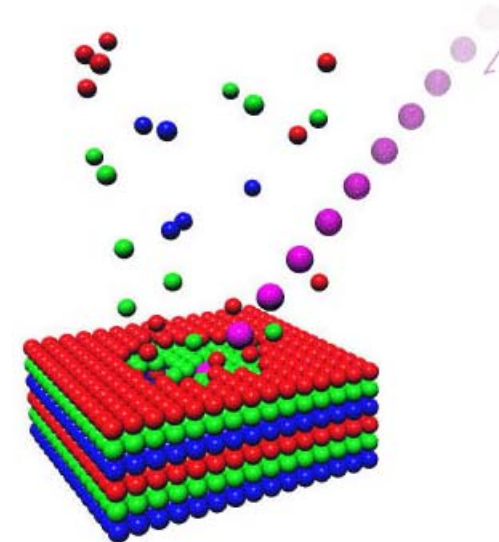
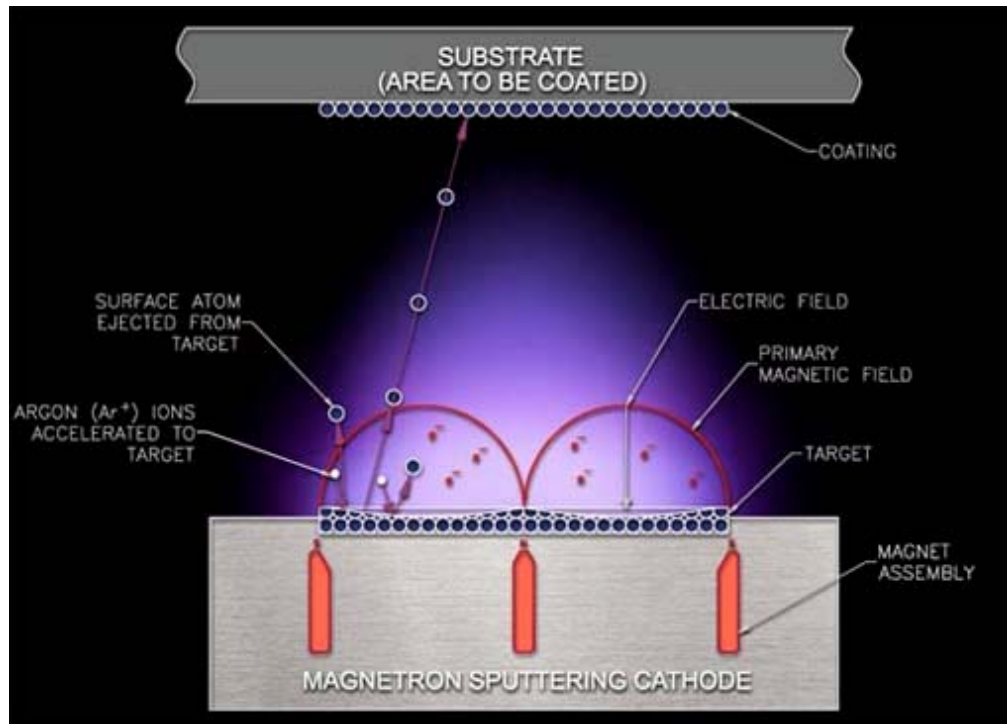
- **Sputtering**
- **Plasma**
- **PE-CVD**

Customers

Agusta Westland, Ferrari Auto, Thales Alenia Aerospace, Avio, Beghelli, Geox, Avel, Bontempi, Brembo, Altay Scientific, Facet, Medys, Collins & Aikman Automotive, Ecomet, Rexam, Bennett Technologies, Matic Plast, Centro Ricerche Fiat, Chanel, Imper, Fabbrica D'Armi Pietro Beretta, B.V.M.Group, European Commission Joint Research Centre, Bitron, La Murrina, Sulzer, Ministero dell'Istruzione dell'Università e della Ricerca, Valeo, Toshiba, Politecnico di Torino, Rinder, Metal 3, Danish Technological Institute, Olsa, Heinz-Glas, Hella, Merloni, Christian Dior, Stanley, CNR-Consiglio Nazionale delle Ricerche, Mantegazza, I Guzzini, Banca d'Italia, BTicino, Flos, Nike, Benetton, Luxottica, Politecnico di Milano, Preciosa, Viola, Fortex, Lasme, Metalfashion, Techno Coatings, Mim, Plasmet, Metalcovering, AnpiMet, Sputtering, Alfra, Ferrero, Viola, TVM, Avm, Metalplastik, Silvan, Linkar, Arthema, Gloss-Tech, Tabone, Basf, Bertolotti, Ccm, Libra, Talus, Margoeder, Stergios, Metaplas Ionon, Cev, Laubscher, Nickel-Chrome, Moma Coatings, Pielle, PVD technologies, Solidea, Rinova, Fustiplast, ACT, Platinum, Manuli, Reggiani, Carrier, Polizia Scientifica Europea, Maxpla, Avoss Design, Topcoat Embal....and many others

What is Sputtering

- Deposition of any metals or alloys on any substrates (metal, glass, plastic, fabric, wood...).



Sputtering characteristics

- Coating with the required thickness
- Multilayers
- Uniform deposition
- Dry process
- Low temperature
- Clean process
- Repeatable



Applications

- Household appliances
- Handles
- Furniture components
- Wheels
- Helmet visors
-
- And also to deposit precious metals like SILVER to enhance the optic reflectance of surfaces.



Sputtering targets

Aluminum, Beryllium, Brass, Cadmium, Calcium, Carbon, Chromium, Cobalt, Copper, Gallium, Gold, Indium, Iron, Magnesium, Manganese, Molybdenum, Nickel, Palladium, Platinum, Rhodium, Ruthenium, Selenium, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zinc, Zirconium...

Any METALS OR ALLOIES

The Plasma Role



Plasma refers to the fourth condition of the matter, it's a partially or totally ionized gas.

Plasma cleaning

A glowing plasma ball with red and blue light trails against a dark background. The plasma ball is the central focus, with a bright red and blue glow. It is surrounded by several bright blue and red light trails that appear to be moving around it, creating a dynamic and energetic scene. The background is dark, making the glowing elements stand out prominently.

- Cleaning to remove organic pollutants
- Pre-treatment to modify the surface characteristics in order to increase the adhesion of the metal onto the substrate, or to prepare the surface for other treatments, like varnishing, gluing ...

Plasma deposition - PECVD

The plasma enhanced chemical vapour deposition is a polymer based process that consists of a transparent coating layer, which can be applied also in the same cycle after the sputter metal deposition and has the following properties:

- Anti-corrosion
- Hydrophobic / Hydrophilic
- Fireproof
- Scratch proof



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.

This is happening for ex. in the automotive industry and also with components for household appliances.



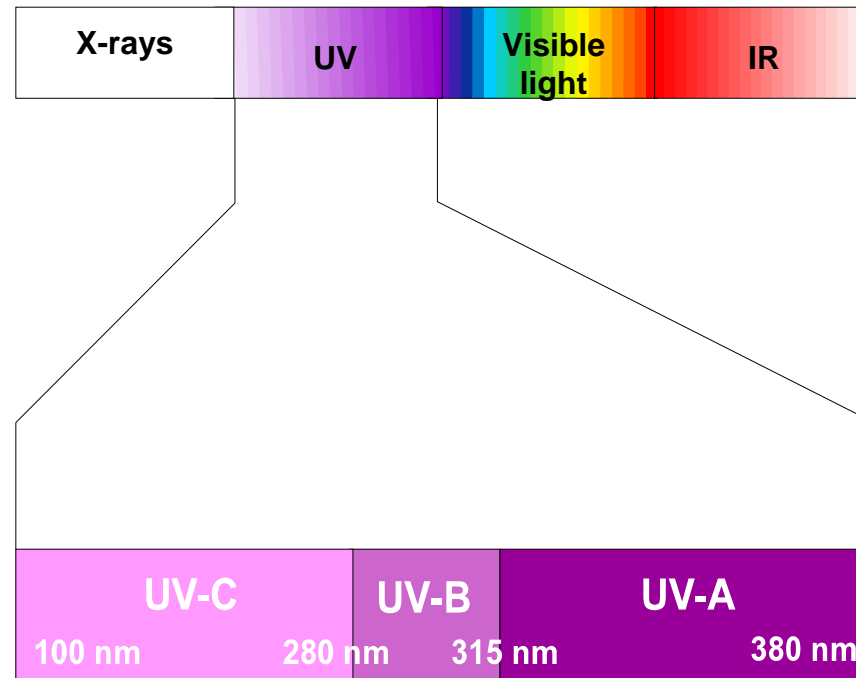
To achieve the higher performance from the deposition, and follow an economical industrial criteria, the coating and deposition rate need to be faster and this generate temperature in the coating process;
the “plastic” substrate can suffer from a thermal shock.

When plastic is not enough performing for sputtering deposition, it is possible to improve hardness and brightness of the substrate applying a UV varnish base-coat.

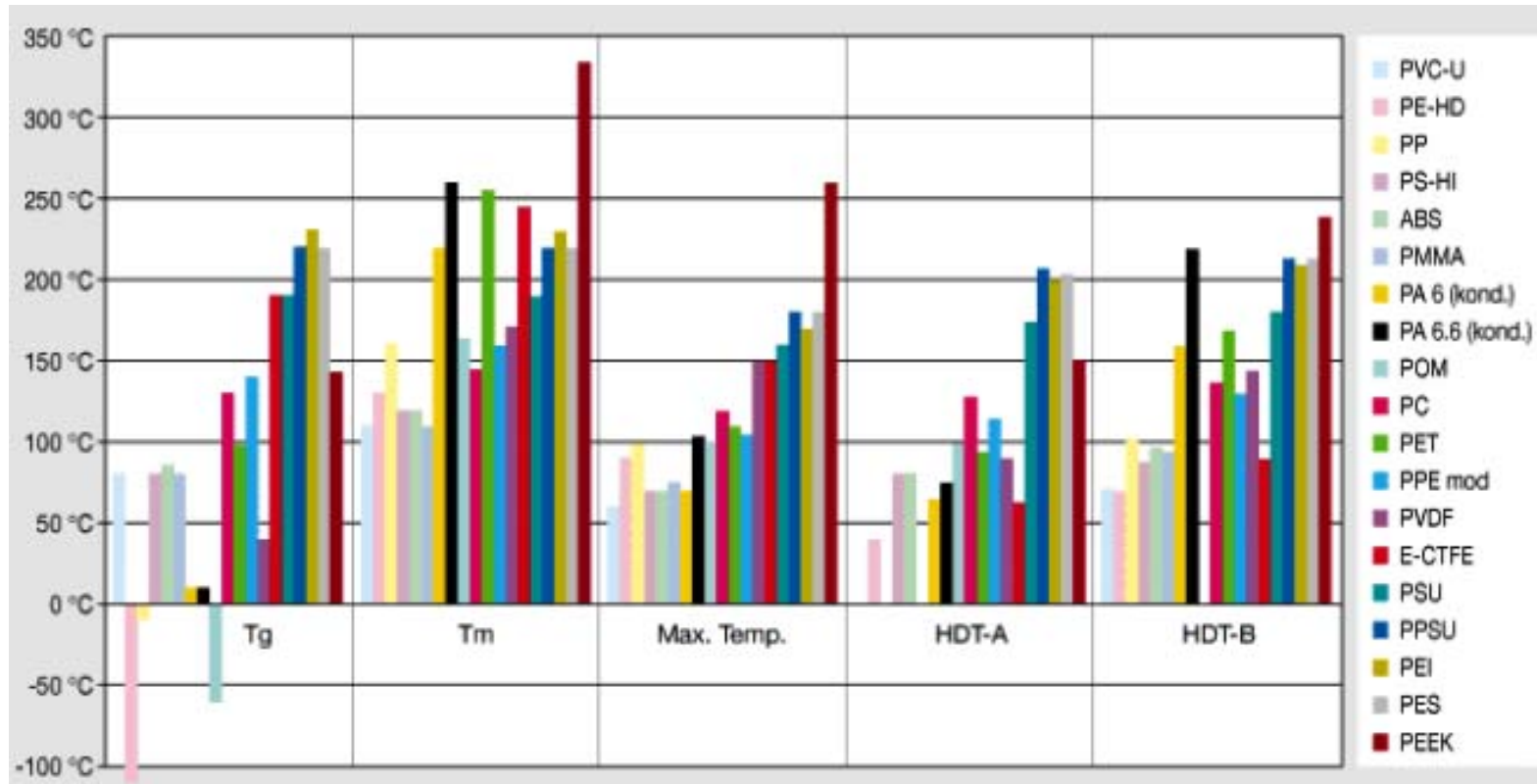


Advantages of UV paint:

- Improved quality (chemically resistant, scratch-resistant, higher gloss)
- Reduced process time
- Reduced space requirements for equipment



Temperature and Polymers



Hardness of Polymers

Polymer	Rockwell		Shore	indentation 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			

Sputtering and Polymers

In order to eliminate the varnish base-coat, a polymer with the following characteristics are required:

- Hardness
- Resistance to temperature
- Brilliancy
- Smooth surface

Case Histories

SUNAGEN srl (www.sunagen.com)

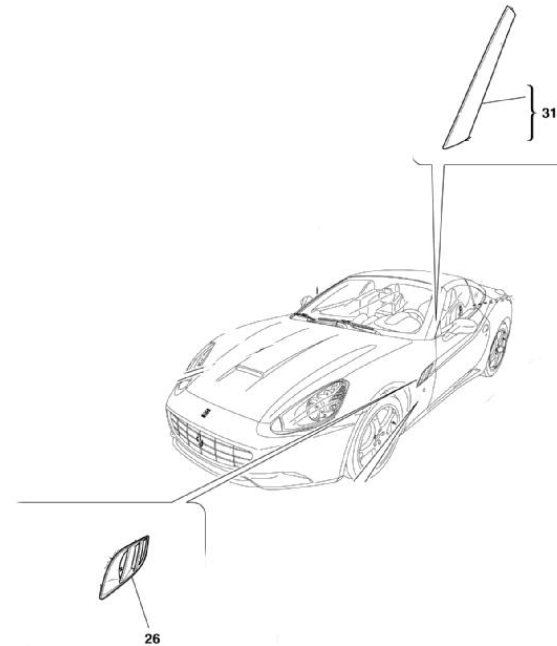
- Goal: to create and make industrially available materials with innovative surfaces in order to add value to products.

Sunagen is equipped with:

- cleaning system
- UV painting line
- sputtering DGK36” machine

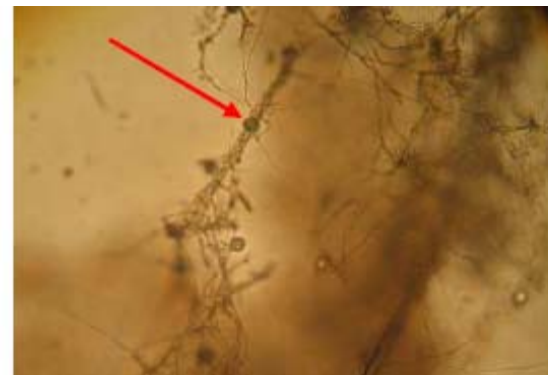
Among their clients:

- Ferrari
- Bang & Olufsen



THALES ALENIA SPACE

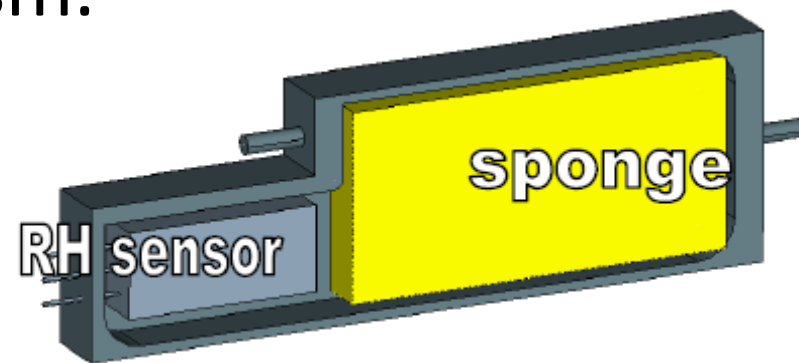
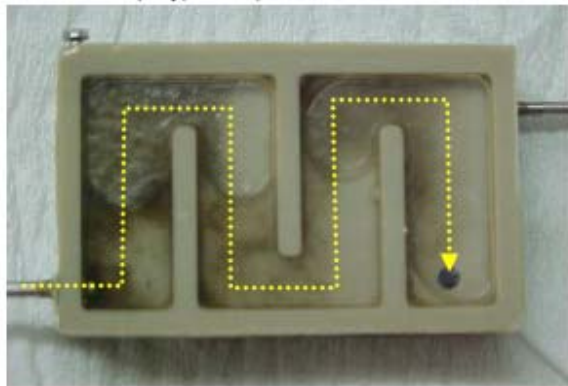
- Project: The experiment will address effects of the space environment on the developmental process of Nematode species.
- Problem of fungi and mold formation on circuits sent into space.



- Solution: Silver-Ion treatment

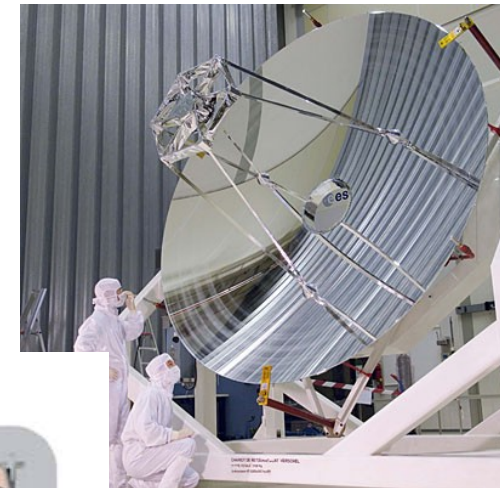
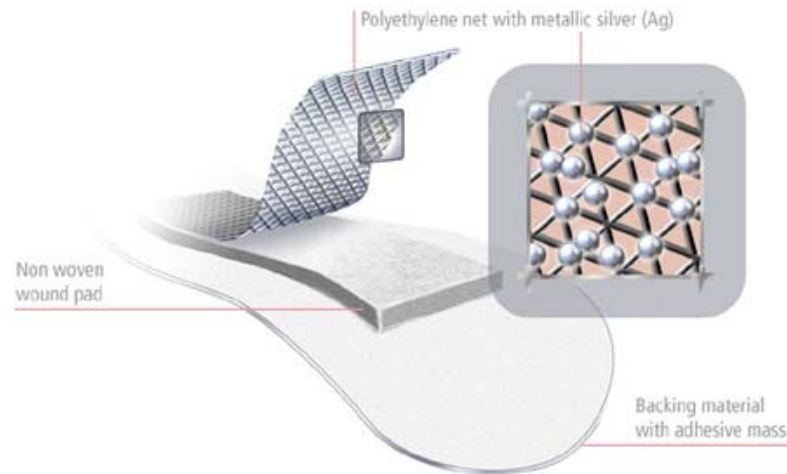
The treatment is based on an activation by cold plasma in vacuum and then a ions deposition of Ag by sputtering.

Ag ions are absorbed by bacteria, breaking their cell walls, inhibiting reproduction and interrupting metabolism.



SILVER: the partner

- Silver coatings are often required on any kind of reflectors because of its reflection properties.
- Silver coating for antibacterial applications.



Future Commitments

- 1° :Promote the use of vacuum sputtering in industry
- 2° : Extend the use of sputtering and nanocomposites on polymers and “technopolymers” as plastic injection is the simplest manufacturing process to produce a 3D part.

Sputtering Vs. Electroplating

- Not only sputtering can replace traditional electroplating in many fields, but even more important is that it can give **new** finishings and conquer new sectors.
- You can sputter any kind of thermosensitive substrates because the process is at **low** temperature
- **No** dangerous **wastes**
- Reduced space requirements for installation



THANKS
Thanks
for your kind attention