SURFACE TAILORING OF COIL COATING USING NANOSTRUCTURED FILMS OBTAINED BY PLASMA POLYMERIZATION OF ORGANOSILANES PRECURSORS

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Coil coatings are widely used as corrosion protection systems. They are one of the most advanced techniques to apply continuously an organic coating on a metal sheet during fabrication. The pre-coated material is a product of consistent quality, with excellent formability, durability, corrosion and weathering resistance. It is however lacking of easy-to-clean and anti-scratch properties with controlled optical properties.

The use of plasma polymerization with organosilane precursors was shown to be an effective route to generate films with such properties. Deposition of plasma polymer nanstructured films on top of coil coating systems provide a possible solution to tailor the surface properties of the coil coating.

The present work is devoted to the investigation of this type of films, which were deposited on top of polyurethane coil coating. The effects of utilization of different plasma reactors, composition of precursor mixtures and gas pressure during polymerization on the properties of the obtained plasma polymer films were studied. Also the influence of the plasma polymerization procedure on the coil coating properties was investigated.

TEM and SEM techniques allowed to study the surface morphology and structure of the plasma polymer films formed, Figure 1. The electrochemical properties of the system were also analysed, as exemplified in Figure 2. Film composition was determined by XPS.

The results demonstrate a strong dependence of the plasma film deterioration on the composition of the gas precursor mixture and operating pressure. Decrease of the operating pressure and of the oxygen concentration in the precursor mixture lead to formation of more compact and nanostructered layers that also showed increased stability. The negative impact on the barrier properties of the coil coating is also strongly dependent on the amount of oxygen present during the polymerization procedure.

Optimization of the operating variables leads to decrease the negative influence of the plasma polymerization process on the weathering properties of the system, keeping the additional properties required.

Keywords: plasma polymerization, coil coating, EIS, AFM, TEM,

Figures:

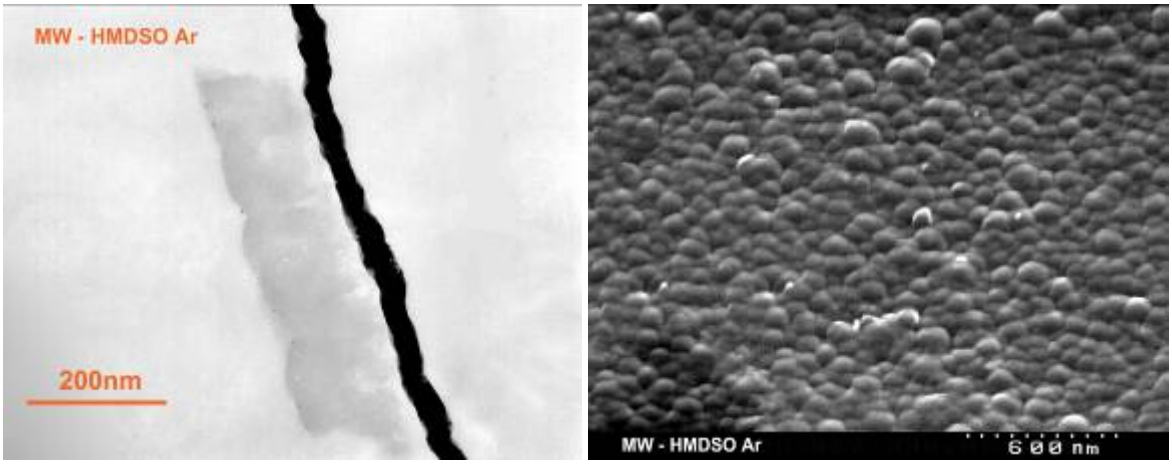

Figure 1 – Nanostructure of the plasma polymer film. Transmission Electronic Microscopy and Scanning Electronic Microscopy techniques.

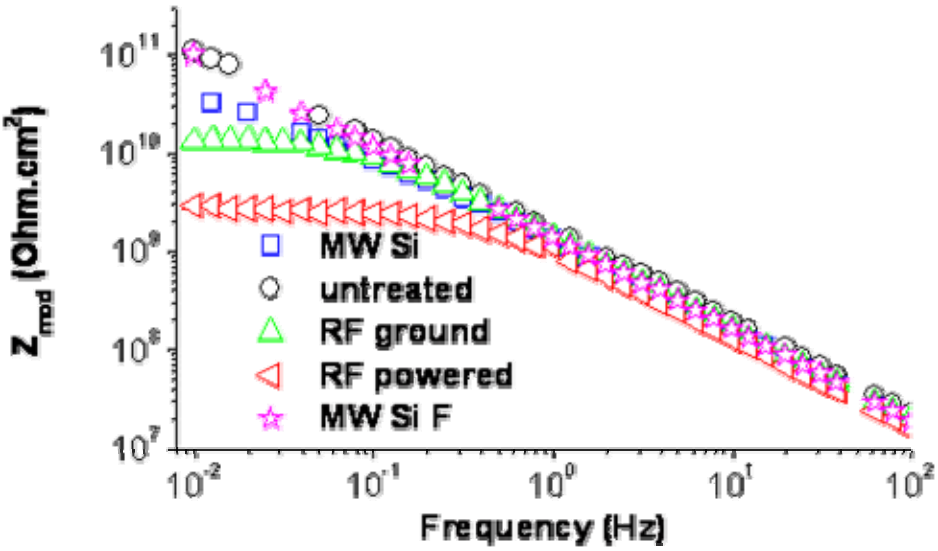

Figure 2 – Influence of different plasma reactors and different precursor mixtures on the barrier properties of the coating system. Electrochemical Impedance measurements.