SESSION *5: New trends in surface science and coatings*

ORAL (invited)

Nanocomposite and nanostructured coatings for oil and gas industrial applications

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Deposition of coatings by chemical route without the adoption of electrical assistance (so-called electroless deposition), is a well-known technique adopted to improve the corrosion and wear resistance of components facing harsh environments.
The principal advantage of electroless technique respect to the corresponding electroplating deposition is the relative easiness of obtaining an uniform coating on complex geometries, without issues related to electrodes shapes and non-uniform electric field, leading to different deposition rates. On the other hand a more accurate optimization of process parameters is mandatory in order to have a stable autocatalytic reaction on the surface. In addition the knowledge of the deposition process allows to extend the technique capability also to obtain more complicated systems (e.g. nanocomposites) for improving the overall coating performances.
One of the most common exponents in this class is the Ni-P coatings, used widely in oil and gas applications to protect from corrosion and erosion the rotating parts of compressors and pumps.

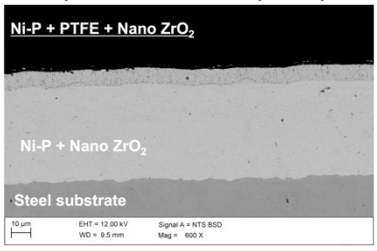

Figure 1 - Hybrid coating

A possible approach to limit the fouling from extracted gases and to raise the erosion resistance is the introduction of nanoparticles (nano-PTFE and nano ZrO_2) into the deposition bath and, in turn, into the coatings, to obtain metal matrix nanocomposites.
In the industrial environments, for the deposition of large and geometrically complex components, the process control is an issue, and this aspect limits the potential diffusion of this class of coatings, particularly for non-standard compositions (e.g. nanocomposites).
The presented project aims to close this knowledge gap and to obtain a family of coatings starting from the standard Ni-P, optimized in terms of resistance and deposition efficiency, and arriving to different nanocomposite coatings able to show relevant properties improvements (antifouling, ductility, corrosion resistance, hardness) and able to be applied to real components.

Figure 2 – Real component coated

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