Corrosion Behavior of Hybrid Coatings: Electroless Ni-Cu-P and Sputtered TiN

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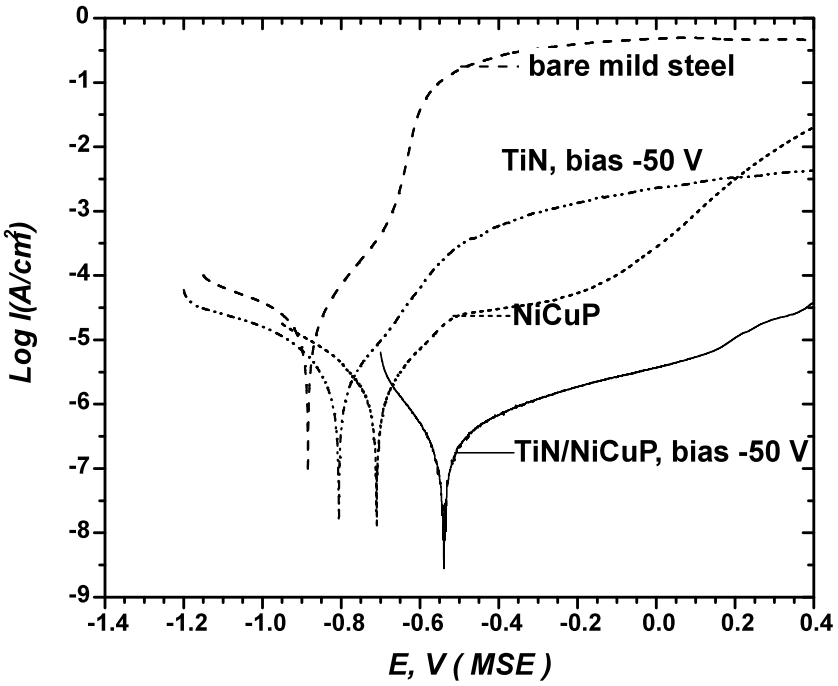
During the last 10-15 years the attention to the electroless plating of nickel-based ternary alloys has been increased because of their excellent corrosion, wear and thermal stability, as well as magnetic properties and electrical resistance. In addition, the introduction of ternary alloys in the practice may help to solve such problems of the contemporary plating as the elimination of lead-based stabilizers in electroless Ni-P solutions and finding alternatives for electrodeposited chromium. On the other hand investigation and production of hybrid materials by combining wet and dry technologies is very prospective. The aim of this talk is to present the origin of electroless deposition of ternary Ni-based alloy and their evolution to hybrid electroless-sputtered multilayered systems.

Initially the motivation for the introduction of a third elements like Cu and Sn in amorphous Ni-P was to reduce the magnetic moment of the precipitated during crystallization Ni-based phase in connection with the production of thin film memory disks. In addition to this effect another beneficial action of the Cu and Sn was discovered: the increase of the crystallization temperature and thus improvement of the thermal stability of the amorphous and paramagnetic state.

Latter the corrosion behavior in chloride and sulfate solutions of Ni-Cu-P and Ni-Sn-P coatings on aluminum alloy substrate in comparison with Ni-P (of similar content of phosphorus) was studied. It was obtained that the introduction of Cu or Sn as a third component improves considerably the corrosion resistance of electroless Ni-P alloys.



Corrosion behavior of coated mild steel in 5% NaCl.

Finally the corrosion tests of multilayers (mild steel/electroless Ni-Cu-P/Ti/TiN in 5% NaCl and 0.5 M H_2SO_4 have been conducted. The detailed investigation of the corrosion places was performed using micro cross-sections made by Focused Ion Beam and using SEM-EDS analysis. The images outlined the role of the high compressive stress in TiN for the formation of damaged areas.