DEVELOPMENT OF A PORTABLE PILOT LINE FOR PURIFICATION OF SPENT PLATING BATHS FROM THE SURFACE TREATMENT INDUSTRY

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ABSTRACT

Electroplating is a flexible low-cost method of manufacturing metallic coatings via the reduction and subsequent deposition of metal cations by applying electric current through an electrolyte bath. This surface treatment can significantly enhance the properties (mechanical strength, chemical resistance) and improve the appearance of various metallic objects and components used in a variety of industries such as aerospace, automotive, medical, electronics, batteries. However, lower than ideal current efficiency during the electroplating process results in the accumulation of metal cations within the electrolyte bath. The gradual increase in the concentration of metal cations to be electrodeposited reaches a threshold beyond which the electrodeposition yield is dramatically decreased, and the bath is characterized as ``spent``. The spent baths should then be removed and transferred to recycling centers [1]. The electroplating industry produces a total amount of 300.000 tons of hazardous wastes per year in the EU area [2].

Creative Nano, as a partner in the EU funded PureNano project, has developed a low cost, sustainable by design method for the purification of spent Ni-P/SiC nanocomposite electroplating baths that can significantly extend their operational lifetime and decrease their environmental impact. Purification is carried out by capturing excess Ni species on the surface of Fe_3O_4-based magnetic nanoparticles (MNPs) which are then removed from the plating bath via magnetic filters [3,4].

Lab scale experiments verified that approximately 10% of Ni(II) cations can be captured from an aqueous solution containing dissolved Ni(II) salts within 5 min after the addition of MNPs at the required Ni/MNP ratio. Creative nano has already designed and installed in its premises a pilot line, capable of purifying and regenerating spent Ni-P/SiC electrolyte baths up to 120 L. The purification pilot line consists of two tanks with integrated motor stirrers, two magnetic filters for removing MNPs and an air diaphragm pump for recirculation of the electrolyte. All parts of the remote pilot line are interconnected with flexible PVC pipes. Operation of the pilot line and preliminary results will be presented.

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KEYWORDS: Spent electroplating baths, Ni-P electroplating, SiC nanoparticles, MNPs

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