Accepted Manuscript

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Please cite this article as: L. Bonin, C.C. Castro, V. Vitry, A.-L. Hantson, F. Delaunois, Optimization of electroless NiB deposition without stabilizer, based on surface roughness and plating rate, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.06.330.

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Optimization of electroless NiB deposition without stabilizer, based on surface roughness and plating rate.

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Abstract

The study of the roughness and plating rate of electroless nickel-boron (NiB) coatings produced without stabilizer and the optimization of bath composition based through an experimental design are herein presented. Experiments were carried out using different combinations of a complexing agent, ethylenediamine, and a pH regulator, sodium hydroxide, used in different concentrations. Sodium hydroxide addition showed to improve the plating rate while the incorporation of ethylenediamine affected the roughness of the film in the studied intervals. The optimum combination of bath composition for minimum roughness with maximum deposition rate was derived from the analysis. In order to obtain a film with a thickness between 10.0 and 10.7 µm and a roughness (Ra) between 0.22 and 0.25 µm, both reagents should be combined in the following concentrations: $120.0 <$ Ethylenediamine (g.L^{-1}) < 128.7 and $151.7 <$ NaOH (g.L^{-1}) < 160.0. The surface and cross-section morphology of the resulting coatings did not present the typical cauliflower-like structure of electroless nickel-boron due to a different mode of growth. The NiB coatings obtained in this study present 8 wt.%. boron in the composition and a surface hardness of 719 hv$_{20}$. High corrosion resistance is observed after 240h of neutral salt spray test.

Keywords: electroless plating ; Nickel-boron ; stabilizer ; roughness ; plating rate, design of experiment.