



Technological University Dublin
ARROW@TU Dublin

Conference Papers

School of Mechanical and Design Engineering

2016

A Comparative Study of Zn-Mn Electrodeposition From Deep Eutectic Solvents and Aqueous Electrolytes

Jelena Bajat
University of Belgrade

Mihael Bucko
University of Belgrade

David Culliton
Technological University Dublin, david.culliton@tudublin.ie

Tony Betts
Technological University Dublin, anthony.betts@tudublin.ie

Follow this and additional works at: <https://arrow.tudublin.ie/engschmeccn>

 Part of the [Materials Science and Engineering Commons](#)

Recommended Citation

Bajat, J., Bucko, M., Culliton, D. and Betts, A. (2016) A Comparative Study of Zn-Mn Electrodeposition From Deep Eutectic Solvents and Aqueous Electrolytes. Abstract of conference paper presented at *EAST / Pulse plating seminar 2016, Baden, Austria, 3 March 2016* doi:10.21427/e23c-3q44

This Conference Paper is brought to you for free and open access by the School of Mechanical and Design Engineering at ARROW@TU Dublin. It has been accepted for inclusion in Conference Papers by an authorized administrator of ARROW@TU Dublin. For more information, please contact yvonne.desmond@tudublin.ie, arrow.admin@tudublin.ie, brian.widdis@tudublin.ie.



This work is licensed under a [Creative Commons Attribution-NonCommercial-Share Alike 3.0 License](#)



A comparative study of Zn-Mn electrodeposition from deep eutectic solvents and aqueous electrolytes

Jelena B. Bajat¹, Mihael Bucko¹, David Culliton², Anthony J. Betts²

¹*Faculty of Technology and Metallurgy University of Belgrade, Karnegijeva 4, 11000 Belgrade, Serbia,* ²*Dublin Institute of Technology, AEG Focas, Kevin St, Dublin 8, Ireland*

The production of Zn-Mn coatings with high Mn and low oxygen content from additive free choline chloride/urea deep eutectic solvent (DES) is reported in this work. Alloy coatings containing high Mn contents (~30 at.% Mn) show the highest corrosion resistance amongst zinc alloys [1]. However, in order to obtain Mn-rich deposits on steel from a simple aqueous bath, a significant cathodic polarization or high deposition current density is necessary. Under such conditions, the Zn²⁺ reduction reaction is under diffusion control, leading to the formation and growth of dendrites. In addition intensive hydrogen evolution significantly reduces the current efficiency, often leading to the formation of porous coatings containing large amounts of oxygen [2]. It has been shown that a dendritic deposit formation and hydrogen reduction during Zn-Mn electrodeposition at high current densities could be prevented through use of plating additives [3].

By utilising DES instead of an aqueous electrolyte Zn-Mn codeposition was successfully achieved, with deposits containing high amounts of Mn at high current efficiencies. The amount of oxygen present in the alloy deposits obtained from DES was significantly reduced in comparison to those prepared from a normal water based electrolyte. Microstructural features and corrosion stability of the DES Zn-Mn deposits are compared with the coatings deposited from a conventional water-based electrolyte. The quantity of water absorbed from the atmosphere in the DES during both the electroplating procedure and throughout the DES storage period is also reported.

The authors would like to acknowledge networking support by the COST Action MP1407

Literature

1. C. Muller, M. Saret, T. Andreu, *J. Electrochem. Soc.* **149** (2002) C600.
2. J. Gong, G. Zangari, *Mat. Sci. Eng. A* **344** (2003) 268.
3. M. Bučko, J. Rogan, B. Jokić, M. Mitrić, U. Lačnjevac, J. B. Bajat, *J. Solid State Electrochem.* **17**(2013) 1409.