Influence of superimposed magnetic field on electrochemical synthesis of multimetallic structures obtained by one-step method

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One-step method consist of single electrodeposition process from an electrolyte containing an addition of crystal modifier. This component allows to synthesize various shaped-structures. It is based on blocking a horizontal direction of growth and promoting of a parallel one. This effect is connected with the screw dislocation driven crystal growth theory [1]. Under certain conditions, it is possible to obtain conical metal and alloy structures. This method does not require to pre-prepared substrate in any way. This method is fast and ensures covering large areas during one, single process.

Co-Fe alloy coatings were synthesized using one-step method from electrolyte containing NH4Cl as a crystal modifier. It allowed to obtain conical structures successfully. The superimposed magnetic field with different directions was applied. The change in alloy composition and morphology of cones was expected due to the ferromagnetic properties of Co and Fe. This influence was investigated using Scanning Electron Microscope photos. XRD analysis was performed to check if there is any change of sample crystal system. The electrocatalytic properties of samples were measured in 1 M NaOH methods and compared with bulk material ones.

The SEM photos of cones obtained in magnetic field are shown in Figure 1.

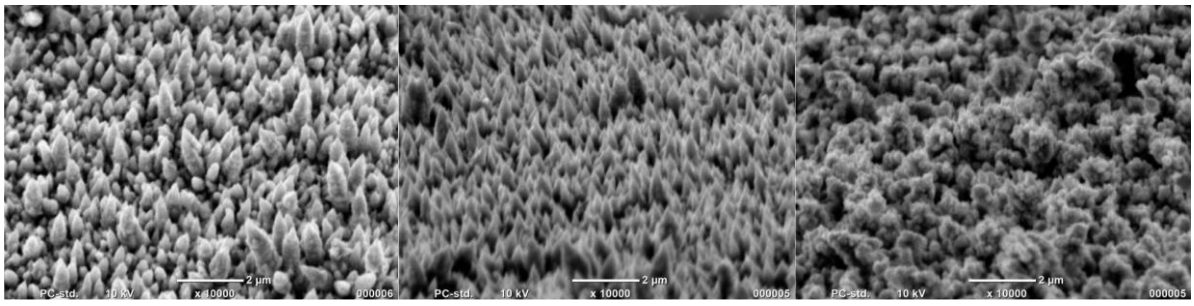

Figure 1. SEM photo of samples obtained a) without magnetic field and at 500 mT in b) perpendicular magnetic and c) parallel magnetic field

There is noticeable influence of magnetic field on coatings morphology. In case of perpendicular magnetic field, the cones shows the best quality. There are sharp-ended with uniform height. The application of parallel direction of field caused a disappearance of conical shape. Structures are complex and round-ended.

REFERENCES

[1] J. M. Lee, K. K. Jung, S. H. Lee, J. S. Ko, Appl. Surf. Sci., 2016, 369, 163-169