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Underpotential deposition (UPD) of Fe, Co and Ni on Gold and Platinum Electrodes in DMSO

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Preparation of ultrathin up to several atomic layers metal structures is important for the development of new materials, e.g., multimetal superlattices and composites, which may play a key role in the development of catalysts, nanoscale devices, and machinery. Current study aimed on understanding of initial stages of deposition of magnetic metals (Fe, Co, Ni) on gold and platinum electrodes.

Deposition of magnetic metals from aqueous solutions is complicated by side reactions usually masking initial stage of formation of monolayer of deposited metal. In previous study we showed that for Ni electrodeposition on Au{111} electrode in DMSO UPD and overpotential (bulk) deposition (OPD) are clearly resolved [1].

Using the same model system we systematically studied underpotential deposition and nucleation of all three magnetic metals on polycrystalline Au and Pt electrodes and textured Au{111} electrode. All systems demonstrated well separated potential regions of UPD and OPD. Initial stages of metal deposition in all systems proceeds through formation of adlayer of elemental sulfur formed simultaneously with metal deposition. Experimental results show possibility of the use of controlled deposition magnetic metals on nanostructured electrodes from DMSO solution.

References:

[1] Vaskevich A., Sinapi F., Mekhalif Z., Delhalle J., Rubinstein I., Underpotential Deposition of Nickel on {111}-Textured Gold Electrodes in Dimethyl Sulfoxide, *J. Electrochem. Soc.* **152** C744-C750 (2005)