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**Title of Thesis**: Electrode position and Characterization of Nanocrystalline Ni-Mo Catalysts

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**Abstract**:

Ni-Mo deposits have been well known for their use as cathodes for hydrogen production from water by electrolysis as well as catalysts for hydrogen production by steam reforming of hydrocarbons. Nanostructured materials offer in general a larger reactive surface area which in this case will serve as a better catalyst. Electrodeposition is one of the most promising techniques for producing nanostructured materials owing to its relative low cost compared to the other methods for production of nanostructured materials. Ni-Mo nanocrystalline alloys and composites were prepared by electrodeposition using direct current from citrate-ammonia solutions in such a manner that the bath contains the same quantity of molybdenum in both cases. The effect of changing the plating current density on the morphology, chemical composition, mechanical and electrochemical properties has been investigated. The molybdenum content in both cases found to decrease by increasing the current density. The crystallite size of Ni-Mo alloys decreases by increasing molybdenum content. Ni-Mo alloys exhibit only a single Ni-Mo (FCC) solid solution phase. The microhardness exhibits a maximum value close to 300 Vickers for Mo content around 23 wt. %. For higher Mo content a softening is observed showing a deviation from Hall-Petch behaviour due to the small crystallite size. In NaOH solution, the corrosion rate of Ni-Mo alloys decreases as the Mo content in the deposited layer is increased and the crystallite size increases. Electrochemical activity for hydrogen production showed to increase mainly due to increases the surface roughness of Ni-Mo alloys. Ni-Mo composites shows a rough and more inhomogeneous surface compared to that for Ni-Mo alloys. The surface roughness is shown to increase by increasing the current density. The corrosion rate of Ni-Mo composites are of higher values that for Ni-Mo alloys. Electrocatalytic effect for hydrogen production is increased by increasing Mo content in the composite as well as increasing the real surface area.

**Keywords**:

Nanocoatings; electrodeposition; Ni-Mo alloys; Hydrogen catalysts.