

Int. J. Electrochem. Sci., 12 (2017) 4692 – 4701

**International Journal of
ELECTROCHEMICAL
SCIENCE**

www.electrochemsci.org

Hydrogen Evolution on Columnar Ni Thin Films Obtained by GLAD

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doi: 10.20964/2017.06.89

Received: 20 March 2017 / Accepted: 18 April 2017 / Published: 12 May 2017

Nanostructured nickel thin films were deposited on glass using glancing angle deposition (GLAD) technique. Cross-sectional field emission scanning electron microscopy images have shown that obtained Ni thin films consist of vertical, tilted or zigzag nano-scaled columns, while X-ray diffraction have shown that (111) orientation prevailed. X-ray photoelectron spectroscopy revealed that apart from metallic nickel, NiO and Ni(OH)₂ were also present in lower amount. Cyclic voltammetry in alkaline solution has shown that hydrogen evolution reaction (HER) was significantly catalyzed on all columnar nanostructures compared to Ni(poly). This was ascribed to the high electroactive surface area (EASA) of porous nickel columns. EASAs for vertical, tilted and zigzag Ni thin layers were higher 32, 25.3, and 24.9 times, respectively, than their geometric areas. Accordingly, Ni thin films with vertical columns have shown the highest activity for HER.

Keywords: nickel thin films, glancing angle deposition, hydrogen evolution reaction, alkaline solution

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