

Synthesis and Structural Characterization of Prussian Blue Thin Films Electrodeposited on Au Substrate

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Prussian Blue $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ is a material with increasing interest for applications such as molecular magnets, electrochromic devices, and electrochemical sensors [1]. Here, Prussian Blue (PB) films up to 650nm thick are deposited by cyclic voltammetry and studied by scanning and transmission electron microscopy and electron and X-ray diffraction. The electrodeposition of PB films is performed in a conventional three-electrode cell with Au (50 nm) on (100) Si n-type as working electrode, platinum foil as counter-electrode, and a saturated calomel electrode (SCE) as reference. The electrolyte at pH 1.5 consisted of 0.5mM of $\text{K}_3\text{Fe}(\text{CN})_6$, 0.5mM FeCl_3 , 1.0M KCl and 0.01M HCl. The layer formation was promoted by sweeping sequentially the potential, for two different scan rates v and a maximum number of 80 cycles. Typical features of anomalous roughening are observed [2]. The surface morphology consists of single crystalline pyramidal grains (Figure 1). In order to determine the preferential direction of growth and the crystalline plane that is parallel to substrate surface, high resolution transmission electron microscopy images and simulations were performed (Figures 2 and 3). According to this analysis, we conclude that the (230) plane is parallel to the interface. However, additional techniques such as electron diffraction are being used to confirm this result.

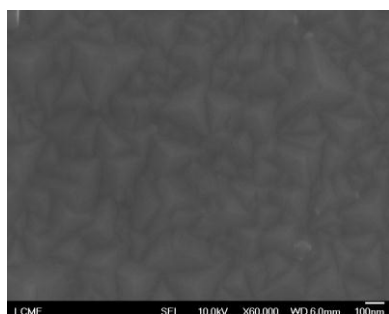


Fig.1: Scanning electron micrograph of typical PB thin film.

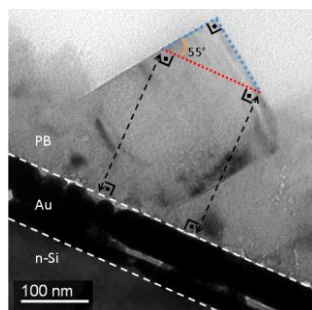


Fig.2 TEM Cross-section view of pyramidal grains of PB.

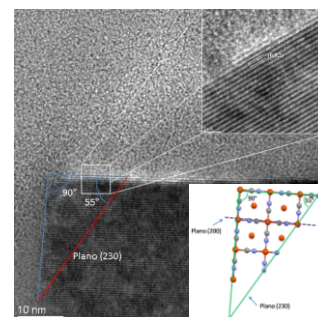


Fig.3 HRTEM image and simulation of PB structure.

Keywords: Prussian Blue, Thin Film, Structural Characterization, Electrodeposition, Electron Microscopy, Electron Diffraction.

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