Glancing Angle Sputter Deposition of PtRu for the Anodic Oxidation of Methanol

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Sputter deposition has been shown to be a very useful technique to increase catalyst utilization (mW/mg) in the anodic electro-oxidation of methanol in Direct Methanol Fuel Cells (DMFCs). [1-2] Unfortunately, sputtered thin-films of Pt (or Pt-alloy) are quite flat. Increasing the thickness (mg/cm^2) of sputtered catalyst layers therefore results in little increase in fuel cell power density (mW/cm^2). However, by varying parameters such as power, pressure, distance, and angle of incidence during sputter deposition, the film porosity and surface area can be increased.

Sculptured Thin Films (STFs) were first conceived of in 1959 [3], and researchers have been using Glancing Angle Deposition (GLAD) to make STFs since 1995. [4-5] These inorganic films are composed of periodic columnar structures with highly determinable aspect ratios, spacing, and shapes. Most applications of this interesting new microstructure have taken advantage of their optical properties. [4-5] Although catalysis has been mentioned as a possible use for STFs, [6] it has only been attempted in a hydrocarbon sensor [7] and photocatalytic TiO_2 [8]. The high porosity and surface area of STFs make them ideal candidates as morphologies for methanol electro-oxidation catalysts.

We have sputtered equiatomic PtRu at varying thicknesses and angles of incidence and have measured their activity for the anodic oxidation of methanol. Results of characterization by SEM, XRD, and STM to determine the mechanism of activity augmentation will be discussed.

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