Nanoporous Cobalt Applied as Catalyst in Ammonia Borane Fuel

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Nanoporous cobalt (NPCo) electrodes have been fabricated by simple leaching melt spun ribbons of a new nanocrystalline precursor from the ternary Co-Cu-Si system. NPCo was characterized by scanning and transmission electron microscopy, x-ray diffraction and nitrogen adsorption technique (BET). After leaching with diluted nitric acid, a tri-dimensional open pore structure with an average pore size of about 26 nm was formed. Chemical microanalysis and electron diffraction patterns showed that the ligaments are formed by σ-Co, Co2Si and Cu0.9Si0.1 as a residual. Cyclic voltammetry at the NPCo electrodes was used to study the oxidation reaction of ammonia borane (AB), an H-rich fuel of interest for direct ammonia borane fuel cells. The onset potential for the oxidation at NPCo shifted to more negative potentials than that observed for commercial platinum nanoparticles supported on high surface area carbon. An onset potential of -1.18 V vs. SCE was observed. The oxidation current for 5 mM AB in 0.1 M NaOH, which increases very fast versus potential, was around 9.0 mA cm-2. These values are comparable or even better the ones observed for NPGold in 1 M NaOH containing 20 mM AB. NPCo is a viable candidate as an anode catalyst for a direct ammonia borane fuel cell.