440b In-Situ Growth of Zeolites and Mesoporous Silica on Metal Substrates

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Hydrogen economy in the forthcoming years demands a need to find viable methods for on-board storage of hydrogen for transportation purposes. Our study is aimed at developing sub-nanostructured metal grids for hydrogen absorption in storage applications. Metal phase will be grown into a zeolite mold which is uniformly grown on the cathode by in- situ hydrothermal synthesis of zeolites. The various parameters involved in modeling in-situ hydrothermal synthesis of zeolite are Al/Si ratio, synthesis reaction chemistry, time-temperature combination for the synthesis and the substrate used for zeolite deposition. Various zeolites synthesized for developing a zeolite layer were faujasite, mesoporous silica and silicalite. Crystal morphology changed with change in concentration of the reaction chemistry. The aspect ratio of silicalite crystals increased by two-fold and the crystal size decreased five fold length and ten fold in width with a four-fold decrease in the reaction chemistry. Time of synthesis also affected change in the zeolite phase, for instance Zeolite-X going to Zeolite-P for longer synthesis times. Choice of the substrate and its surface morphology also affects the growth of the zeolite layer. Micro-scale “roughening” of the metal surface serves as nucleation sites during zeolite synthesis and thus provides better adhesion between the metal and zeolite film. For this reason, sintered copper surface with particle size in the range 50 microns – 75 microns were employed as the substrate. Hydrothermal faujasite synthesis is performed to control morphology for better adhesion to the cathode. Physical characterization techniques include SEM, AFM, HRTEM and XRD. The technical approach involves, coating a cathode with zeolites to act as template.