Materials Science & Engineering Master's Defense

Growth and Characterization of Pyrite Thin Films for Photovoltaic Applications

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abstract

A series of pyrite thin films were synthesized with a novelmethod for studying the effects of growth temperature on thin filmgrowth rate and micro-structure. This novel method involves the deposition of Fe followed by immediate reaction with S gas to form pyrite in a layer by layer fashion. Thin films were synthesized using two growth processes; a one-step process in which a constant growth temperature is maintained throughout growth, and a three-step process in which an initial low temperature seed layer is deposited, followed by a high temperature layer, and then finished with a low temperature capping layer. Analysis techniques include Glancing Angle X-Ray Diffraction (GAXRD), Rutherford Back-scattering Spectroscopy (RBS), Transmission Electron Microscopy (TEM), Secondary Ion Mass Spectroscopy (SIMS), 2-point IV measurements, and Hall effect measurements Analysis found that crystallinity improved with increasing growth temperature. It was found using TEM, for growths using a threestep process, that grain morphology of the seed, high-temperature, and capping layers differ from each other. The sticking coefficient of Fe was found to increase with increasing growth temperature, indicating that the Fe incorporation into the growing film is a thermally activated process.

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