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An EXAFS Analysis of Cu_2SnS_3 for Extremely Thin Absorber Layer LEILA JEWELL, ANDREW SHORT, FRANK BRIDGES, GLENN ALERS, UC Santa Cruz, JOHN NORMAN, Air Products, SUE A. CARTER, UC Santa Cruz
— We present local structure studies of Cu_2S and Cu_2SnS_3 composite films prepared with CVD, using extended x-ray absorption fine structure (EXAFS) technique. The EXAFS technique has the ability to probe the local environment of specific atoms, and can also give very precise ratios of elements using their fluorescence peaks. Chemical vapor deposition (CVD) deposits highly conformal films and hence is an important tool for developing nanostructured solar cells with scalability. Cu_2SnS_3 is an earth-abundant absorber that is even more cost-effective when used in an extremely thin absorber solar cell. Composite films of Cu_2SnS_3 were made using CVD layers of Cu_2S and Tin (IV) Sulfide (SnS_2) with an anneal step. Cu_2SnS_3 also has the same structure as ZnS, which allows for the formation of the quaternary Cu_2ZnSnS_4 by depositing ZnS on top of the Cu_2S and SnS_2 layers determined for Cu_2SnS_3. Stoichiometric control was established by varying the deposition times of the binary compounds and was measured using energy-dispersive x-ray spectroscopy (EDX), x-ray diffraction (XRD), and EXAFS techniques. Optical absorption results are promising for forming a photovoltaic device with copper-based ternary and quaternary materials as the absorber.

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