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Bipolar Doping Control in Sputter-deposited Cu_3N Thin Films as a Function of Growth Conditions[1] ANGELA FIORETTI, Natl Renewable Energy Lab, Colorado School of Mines, STEVEN CHRISTENSEN, DAVID S. GINLEY, Natl Renewable Energy Lab, ERIC S. TOBERER, Natl Renewable Energy Lab, Colorado School of Mines, ANDRIY ZAKUTAYEV, Natl Renewable Energy Lab — Experimental evidence of Cu_3N defect-tolerance has been observed in that it can be doped either n-type or p-type based solely on growth conditions. In this presentation, the control of bipolar doping behavior as a function of growth conditions in Cu_3N is demonstrated, and hypotheses as to the underlying physics of this behavior are explored. Thin films of Cu_3N were deposited using reactive RF-magnetron sputtering. Growth temperature and target power density were varied respectively in two sets of experiments. For both sets, Hall effect and Seebeck coefficient measurements were used to characterize carrier type. Furthermore, NEXAFS measurements were performed to investigate the fundamental differences in structure that may give rise to Cu_3N bipolar doping. Cu_3N grown under conditions in which the activity of nitrogen was low exhibited n-type conductivity, while films grown under conditions in which the activity of nitrogen was high exhibited p-type conductivity. NEXAFS measurements revealed the presence of mixed Cu valence (both Cu^{+1} and Cu^{+2}), and this discovery helped to shed light on the underlying physics behind Cu_3N bipolar doping behavior.

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