Optical Properties of Reversible Phase-Change SilverSelenide Thin Films by Co-Sputtering for Smart Window Applications

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Silver selenide (Ag_2Se)has drawn interest in a property of reversible solid-state phase transition,which is suitable for switching devices. It has the polymorphic phase transitiontemperature of 403 ‡ 2 K and the reverse transition occurred at around 373 K [1],which leads to an abrupt change in physical properties, such as electrical,thermal, and ionic properties, without changing their chemical composition. Thesilver selenide is generally known for two kinds of stable crystallinepolymorphs of the narrow band-gap orthorhombic phase (β-Ag_2Se) and the superionic cubic phase (α-Ag_2Se) [2]. There is veryfew literature about the optical properties of this silver selenide, except itsband gaps of 1.3-1.6 eV; therefore, it is of much importance to investigationson the phase-dependent optical properties of the silver selenide. In this study, silverselenide thin films were deposited using both Ag and Se targets by radio frequencymagnetron sputtering which has several advantages such as superior adhesion of thinfilms and easy control for deposition rate. Thesilver selenide thin films were prepared with various ratios of concentrationby co-sputtering method. Some physical characteristics were measured in eachsolid-state phase by controlling RTA temperature for phase-transition. Structural properties of the thin films were analyzedby using X-ray diffraction. Optical and electrical characteristics of the thinfilms were analyzed by using an UV-Visible spectrophotometer and a Hall effectmeasurement system.

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