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Control of electrical properties of BaSi₂ thin films by alkali-metal doping using alkali-metal fluorides

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Abstract

Exploration of impurity elements for carrier density control is important for device application of the BaSi₂ semiconductor, which is a promising candidate for an earth-abundant solar cell absorber. In this study, we have investigated the doping of BaSi₂ films with alkali metals (Li, Na, and K) by deposition of alkali-metal fluorides followed by rapid thermal annealing. Electrical characterization by Hall measurement shows that LiF treatment increases electron density in BaSi₂ up to 10²⁰ cm⁻³ after annealing at 500 °C while NaF and KF treatments have limited effects with electron densities lower than 10¹⁸ cm⁻³. The mechanisms of electrical property modification are discussed from structural viewpoints. Secondary ion mass spectroscopy shows that Li atoms slightly diffuse into the film at 400 °C by prolonged

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