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Formation of n-Type β-$FeSi_2$/p-Type Si Heterojunctions by Facing-Targets Direct-Current Sputtering SHOTA IZUMI, NATHAPORN PROMROS, Kyushu University, MAHMOUD SHABAN, South Valley University, KEITA NOMOTO, TSUYOSHI YOSHITAKE, Kyushu University, KYUSHU UNIVERSITY TEAM, SOUTH VALLEY UNIVERSITY TEAM — Semiconducting iron disilicide (β-$FeSi_2$) possessing a direct band gap of 0.85 eV and a large absorption coefficient of 10^5 cm^{-1} at 1.5 eV is a new promising material for infrared photodiodes. In order to fabricate the heterojunction with Si, the diffusion of Fe atoms from the β-$FeSi_2$ layer into the Si substrate should be suppressed because the Fe atoms form trap centers in the Si. Epitaxial as-growth of β-$FeSi_2$ films at a low substrate-temperature is preferable. In this study, β-$FeSi_2$ thin films were epitaxially grown on Si(111) substrates at a substrate-temperature of 600 $^\circ$C by facing-targets direct-current sputtering (FTDCS) without post-annealing at high temperatures. The β-$FeSi_2$ thin film exhibited a smooth surface with few pinholes and a sharp interface with the Si substrate. It was confirmed that the β-$FeSi_2$ film is epitaxially grown on Si(111) by the XRD measurements. The n-type β-$FeSi_2$/p-type Si heterojunction showed a typical rectifying action with a rectification ratio of more than two orders of magnitude at bias voltages between $\pm$ 1 V at room temperature.

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