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Characteristics of Near-Infrared n-Type Nanocrystalline $FeSi_2$/i-Si/p-Type Si Heterojunctions prepared by Facing-Targets Direct Current Sputtering NATHAPORN PROMROS, KENJI KAWAI, Kyushu University, MAHMOUD SHABAN, South Valley University, TSUYOSHI YOSHITAKE, Kyushu University, KYUSHU UNIVERSITY TEAM, SOUTH VALLEY UNIVERSITY TEAM — Nanocrystalline (NC) iron disilicide ($FeSi_2$), which comprises crystals with diameters ranging of 3-5 nm, is a new semiconducting material. NC $FeSi_2$ possesses the similar semiconducting properties to β-$FeSi_2$. In our previous research, we have successfully deposited NC $FeSi_2$ films by facing-targets direct current sputtering using sintered $FeSi_2$ targets with a chemical composition between Fe and Si of 1:2. In this study, near-infrared n-type nanocrystalline $FeSi_2$/i-Si/p-type Si heterojunction photodiodes were prepared by the same sputtering method. The current-voltage characteristics were measured in the temperature range of 60 - 300 K. With a decrease in the temperature, the dark current was markedly reduced and at 60 K a rectifying current ratio in the dark became more than three orders of magnitude at between applied voltages of ± 1 V. The ratio of the photocurrent to the dark current was also dramatically enhanced to be more than three orders of magnitude, and the device detectivity was estimated to be 3.0×10^{11} cm $Hz^{1/2}/W$ for 1.31-μm light at 60 K.

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