n-Type $\beta$-FeSi$_2$/$p$-Type Si Hererojunction Photodiodes Fabricated by Facing Targets Direct-Current Sputtering

SHOTA IZUMI, Kyushu University, NATHAPORN PROMROS, Kyushu University, MAHMOUD SHABAN, South Valley University, TSUYOSHI YOSHITAKE, Kyushu University — Semiconducting iron disilicide ($\beta$-FeSi$_2$) has been received much attention, since this material has several attractive characteristics. Specifically, it is a new candidate material for near-infrared (NIR) photodetectors for optical fiber communication because its optical band gap is optimum for operating at wavelengths of 1.3 and 1.55 $\mu$m. In this study, $\beta$-FeSi$_2$ thin films were epitaxially grown on Si(111) substrates by facing targets direct-current sputtering (FTDCS) at a substrate-temperature of 600°C without post-annealing at a high temperature. In the dark and under illumination at a wavelength of 1.31 $\mu$m, the photodiode performance was measured in the temperature range from 50 to 300 K. At a low temperature, the performances were remarkably improved as compared with those at 300 K. The $R_0A$ product and detectivity at 50 K were estimated to be $2.0 \times 10^8$ $\Omega$ cm$^2$ and $2.8 \times 10^{11}$ cm$^{-1}$Hz$^{1/2}$/W, respectively.

Shota Izumi
Kyushu University