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Sputtering deposition of ZnGaInON with tunable bandgap for photovoltaics RYOTA SHIMIZU, KOICHI MATSUSHIMA, DAISUKE YAMASHITA, GIICHIRO UCHIDA, HYUNWOONG SEO, KAZUNORI KOGA, MASAHARU SHIRATANI, NAHO ITAGAKI, Kyusyu University — A material having tunable bandgap is required for significant advance in third generation photovoltaics. Here we propose a novel oxynitride semiconductor ZnGaInON(ZGION), that is a mixed crystal of ZnO, GaN, and InN, and has wurtzite crystal structure. [1] It is fabricated by RF magnetron sputtering. The fascinating feature of ZGION is that the bandgap and the carrier density are controlled by changing the chemical composition ratio. The bandgap has been tuned in a wide range from 1.8 eV to 2.7 eV by controlling [In]/([Zn]+[Ga]+[In]), being ascribed to the narrow bandgap of InN. While the electron carrier density has been reduced from 1.34x1021 cm^{-3} to 7.61x1020 cm^{-3} by increasing [Ga]/([Zn]+[Ga]+[In]), suggesting that Ga ions play important roles in suppression of carrier generation via anion vacancy formation. These results indicate that ZGION is a potential material for photovoltaics.

[1] N. Itagaki, et al., "Oxynitride semiconductor," U.S. Patent No. 8274078 (2012).

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