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Photo-Seebeck effect of ZnO single crystals and thin films RYUJI OKAZAKI, AYAKA HORIKAWA, MASARU FUJITA, HIROKI TANIGUCHI, ICHIRO TERASAKI, Nagoya Univ, HIROMICHI OHTA, Hokkaido Univ — We have investigated the thermoelectric properties of ZnO single crystals and thin films under illumination. In both samples, the electrical conductivity and the Seebeck coefficient are varied under ultraviolet light ($h\nu = 3.4$ eV) while a negligible change is observed under visible green light ($h\nu = 2.4$ eV), indicating a carrier excitation across the band gap of ZnO ($E_g \sim 3.3$ eV) by the ultraviolet illumination. This phenomenon thus can be ascribed to a photo doping effect into thermoelectric materials [1]. The carrier concentration doped by illumination is estimated to be about 10^{19} cm^{-3}, which is close to the optimal value for conventional thermoelectrics, suggesting a possible optical control of the thermoelectric efficiency. We also investigate the sample thickness dependence of the photo-Seebeck effect in ZnO thin films, whose thickness is comparable to the absorption length of ultraviolet light. These results are compared with the bulk sample results in terms of a parallel-circuit model consisting of photo-excited metallic and unexcited insulating layers.

[1] R. Okazaki *et al.*, J. Phys. Soc. Jpn. **81**, 114722 (2012).

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