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Spin relaxation and transport mechanics in ZnO thin films
MEGAN PRESTGARD, GENE SIEGEL, University of Utah, Department of Materials Science and Engineering , ROBERT ROUNDY, MIKHAIL RAIKH, University of Utah, Department of Physics, ASHUTOSH TIWARI , University of Utah, Department of Materials Science and Engineering — Zinc oxide has been widely used in optoelectronic and lasing application due to its wide-bandgap and large exciton binding energy. In recent studies, it has also been studied for spintronic device applications due to its relatively large spin-orbit coupling and potential as a dilute magnetic semiconductor. However, a fundamental understanding of spin transport and relaxation mechanisms has not yet been reached. Knowledge of these mechanisms is required in order to accurately explain and enhance spin-based effects in ZnO. To study spin transport and relaxation in ZnO, four-probe non-local Hanle measurements were performed on thin film samples. These samples were grown using a pulsed laser deposition technique under low ambient oxygen pressure. Under these conditions, the films grown are degenerately doped, with a carrier concentration on the order of 10^{19} cm^{-3}. Taking this into account, the spin lifetime results can be explained by Dyakonov-Perel (DP) relaxation mechanisms using Fermi-Dirac statistics.

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