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Diffusion of ion implanted indium in ZnO crystals FAISAL YAQOOB, MENGBING HUANG, University at Albany-SUNY, DAVID LOOK, Wright State University and Air Force Research Laboratory — We report on diffusion behaviors for ion implanted indium atoms in ZnO crystals. A c-plane ZnO crystal was implanted with In ions for four different energies (40, 100, 200, and 350 keV, respectively) and doses (8.0×10^{13}, 1.2×10^{14}, 1.6×10^{14} and 6.5×10^{14} /cm^2, respectively), resulting in a uniform concentration profile of In from surface to the depth $\sim$ 150 nm. The samples were annealed for 30 minutes at temperatures between 700-1000 $^\circ$C with an argon or oxygen gas flow. The distributions of In atoms, either aligned or nonaligned along the crystalline directions, were measured by Rutherford backscattering combined with ion channeling. The diffusivities for nonaligned (interstitial) and aligned In atoms varied with annealing temperature via the Arrhenius relationship. The diffusion activation energies (E_a) for aligned In atoms were lower than those for interstitial In atoms, e.g., for annealing in an Ar gas, E_a $\sim$ 0.61 eV for <1010> aligned In atoms and E_a $\sim$ 1.1 eV for interstitial In atoms between <1010> atomic rows. Furthermore, the diffusion activation energies were affected by the gas species used during annealing, e.g., for annealing in an O_2 gas, E_a $\sim$ 0.39 eV for <1010> In atoms and E_a $\sim$ 0.79 eV for interstitial In atoms between <1010> atomic rows. These experimental results will be compared with first-principle calculations for In diffusion in ZnO crystals.

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