Abstract Submitted
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Metastable defects are the origin of high conductivity in gallium doped zinc oxide[1] ANDRIY ZAKUTAYEV, National Renewable Energy Laboratory, NICOLA PERRY, THOMAS MASON, Northwestern University, DAVID GINLEY, STEPHAN LANY, National Renewable Energy Laboratory — Doping in wide-bandgap materials is often counteracted by formation of intrinsic compensating defects of opposite charge. One prototypical exception to this general rule is gallium doped zinc oxide (ZnO:Ga) used as transparent conductor in numerous applications. High conductivities (1,000-10,000 S/cm) in ZnO:Ga are typically achieved during the growth at 250 - 350C around 10ˆ-8 atm. The corresponding electron concentration exceed by a factor of 100,000 the values expected in equilibrium from first principles calculations. In contrast at high temperature and high oxygen partial pressure conductivity of ZnO:Ga measured in-situ shows good agreement with the ab initio theoretical thermodynamic model. The results of this study indicate that degenerate levels of doping in ZnO:Ga transparent conductive oxide used in practical applications are enabled by non-equilibrium concentration of both extrinsic donors and compensating acceptors. [1] A. Zakutayev et al, Appl. Phys. Lett.

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