Materials Science & Engineering and Metallurgical Engineering Graduate Seminar

Wednesday, December 5, 2018, 4:10-5:00PM, WEB 1230

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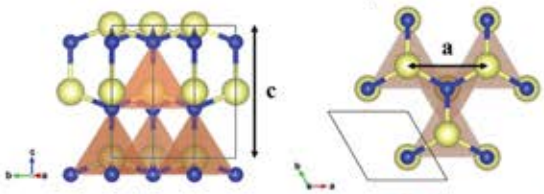
Thermoelectric properties of zinc oxide dually doped by trivalent elements M (M=In, Al, Ga, Bi, B)

This research aims to investigate the effect of dual doping on the crystal structure and high-temperature thermoelectric properties of zinc oxide (ZnO). Pure ZnO is a poor electrical conductor with a wide band gap, low carrier concentration, and high electron mobility. Doping is the main approach to improve the electrical conductivity of the system as it can increase carrier concentration and/or reduce the forbidden band gap. The thermal conductivity can also decrease significantly because of the introduction of disorder in the system. In our research, we introduced several trivalent dopants including indium, aluminum, gallium, boron, bismuth into ZnO, and studied the thermoelectric properties of the resulting material. Since thermoelectric properties are related to the Seebeck coefficient, electrical conductivity, and thermal conductivity of materials, experiments were devised to determine these three metrics. X-ray diffraction (XRD) and scanning electron microscopy analysis were conducted to characterize the structure of samples. XRD Rietveld refinements were performed to calculate the lattice parameters of doped ZnO, which revealed chemical expansions in the crystals. A relationship between the structure and thermoelectric properties in ZnO were discussed in the paper. Finally, a maximum value of ZT around 0.25 at 720 K was obtained in indium/bismuth-doped ZnO.



Yinong Yin is a fourth-year Ph.D student in the department of materials science and engineering at the University of Utah. She focuses on the thermoelectric study during her Ph.D. So far, she has done research on bulk ceramics and thin films. Her research is about understanding the structure-property relationship in these promising thermoelectric systems.