Materials Science & Engineering and Metallurgical Engineering Graduate Seminar

Wednesday, February 20 2019, 4:10-5:00PM, FASB 295

Yinong Yin

PhD candidate in Materials Science & Engineering
University of Utah

Effect of Thickness on the Thermoelectric Properties of $Ca_3Co_4O_9$ Thin Films

We are reporting the effect of thickness on the Seebeck coefficient and electrical conductivity of $Ca_3Co_4O_9$ thin films grown on single-crystal sapphire (0001) substrate. Pulsed laser deposition (PLD) technique was employed to deposit thin films of $Ca_3Co_4O_9$ with gradual increment in thickness. Structural characterization performed by scanning electron microscopy (SEM) and atomic force microscopy (AFM) showed grainy and rough topological textures, indicating an island growth mode of the $Ca_3Co_4O_9$ thin films on sapphire substrate. It was observed that in-plane grain sizes decrease from ~126 nm to ~31 nm as the thickness of the films decreases from 75 nm to 15 nm. The thermoelectric power measurements showed that the maximum value of Seebeck coefficient in our $Ca_3Co_4O_9$ thin films reached 219.51 μV/K at 720 K, which was almost twice the value measured for our $Ca_3Co_4O_9$ bulk sample. However, in spite of significantly improved Seebeck coefficient simultaneous decrease in electrical conductivity was observed due to existence of energy barriers at grain boundaries which trapped free charge carriers. Overall, power factors of the $Ca_3Co_4O_9$ films were found to be of similar magnitude as of the bulk sample.

Yinong Yin is a fourth-year Ph.D. student in the department of Materials Science and Engineering at the University of Utah. She works with her advisor, Professor Ashutosh Tiwari, where she focuses on studying thermoelectric properties of oxides.