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Neutron Scattering Studies of Thermoelectric Materials for Automotive Applications[1]

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Solid-state thermoelectric (TE) technology uses electrons and holes as the working fluid for heat pumping and power generation, and has the virtues of no moving parts and high reliability. Advances in TE materials can lead to high thermal-to-electrical energy conversion efficiency and hence significant energy savings by generating electricity from waste heat. A good TE material should simultaneously possess high thermopower, low electrical resistivity, and low thermal conductivity. Most of the work in the past decade has been focused on lowering materials lattice thermal conductivity. Neutron diffraction and inelastic neutron scattering provide unique opportunities to understand the vibrational properties of thermoelectric materials. I will review some of our recent neutron studies on skutterudites, prospective high efficiency TE materials. Our studies have attempted to elucidate the crucial factors in these compounds relating to the filling-atom sublattices, particularly with respect to composition, nature of mixed fillers, dynamic disorder, phase coherence, and phonon scattering mechanisms.

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