Hall-effect study of multiband nature in $FeSe_{1-x}Te_x$ thin films

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Hall effect is investigated in detail for iron-chalcogenide superconductor thin films. In the parent compound, FeTe, Hall resistivity is linear to H, and Hall coefficient (R_H) exhibits a sign reversal from positive to negative associated with antiferromagnetic (AFM) phase transition. Mobility analysis based on a simple two-band Drude model reveales that the hole mobility is suppressed almost to zero in non-superconducting FeTe, while that of superconducting FeTe remains finite, which suggests the importance of itinerancy of holes to superconductivity [I. Tsukada *et al.*, J. Phys. Soc. Jpn. **80**, 023712 (2011)]. In $FeSe_{0.5}Te_{0.5}$, R_H value strongly depends on the lattice parameters of $FeSe_{0.5}Te_{0.5}$ at high temperature, indicating the strong correlation between band structure and charge transport in the normal state. At low temperature, nonlinearity of Hall resistivity to H becomes remarkable, and much complicated interplay between electron- and hole-type carriers is expected. In particular, magnitude of R_H is significantly scattered at low temperature showing almost no obvious correlations with T_c, indicating that charge carriers that belong to different bands may contribute differently to the electrical transport when the superconducting state is approaching.