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Superconducting and magnetic properties of Fe-Se-Te compounds
C.V. TOMY, G. BALAKRISHNAN, M.R. LEES, Department of Physics, University of Warwick, Coventry CV4 7AL, UK — The discovery of a new Fe based superconductor \( \alpha \)-FeSe\(_x\) with a \( T_c \) of 8 K, hot on the heels of the discovery of superconductivity in LaOFeP/As compounds, has triggered a fresh interest in the study of Fe based superconductors. Se can be replaced with Te in FeSe\(_{1-x}\)Te\(_x\) and this results in an increase in \( T_c \) from 8 K for \( x = 0 \) to 15 K for \( x = 0.5 \) while compounds for \( x > 0.8 \) are no longer superconducting. We report the synthesis and characterization of the compounds FeSe\(_{1-x}\)Te\(_x\) covering the entire solid solution range. The superconducting transition in resistivity measurements does not show any broadening in magnetic fields up to 9 T, but shifts to lower temperatures linearly with a value \( \sim -0.22 \) K/T. This results in extremely high upper critical fields \( H_{c2} \) of the order of 70-80 T in these compounds. The superconducting properties are also sensitive to applied pressure and exhibit a positive \( dT_c/dP \) of around 0.41 K/kbar for the \( x = 0.5 \) composition. We observe a jump in specific heat at \( T_c \) corresponding to a superconducting gap of 1.8 meV, indicating the bulk nature of superconductivity. Detailed investigations through magnetization, transport and specific heat measurements are presented. A study of the magnetic properties of the non superconducting end compound, FeTe is also presented to gain insight into the onset of superconductivity in the doped systems.

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