

μ SR studies of topological superconductors $\text{Cu}_x\text{Bi}_2\text{Se}_3$ and $\text{Sn}_{1-x}\text{In}_x\text{Te}$

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$\text{Cu}_x\text{Bi}_2\text{Se}_3$ and $\text{Sn}_{1-x}\text{In}_x\text{Te}$ are prime candidates for the topological superconductor which is characterized by a topologically protected gapless surface state. Signatures of surface Andreev bound states were observed from the point contact spectroscopy. A time-reversal-invariant topological superconducting state is theoretically predicted. We have performed detailed zero-field (ZF) μ SR measurements in $\text{Cu}_{0.3}\text{Bi}_2\text{Se}_3$ and $\text{Sn}_{0.55}\text{In}_{0.45}\text{Te}$. For the both superconductors, the ZF relaxation rate shows almost no temperature dependence, suggesting that time reversal symmetry is preserved. In a transverse field (TF) of 300 G parallel to c axis, we observed a very small but well-defined increase in the relaxation rate below $T_c \sim 3$ K for $\text{Cu}_{0.3}\text{Bi}_2\text{Se}_3$. The estimated value of $\sigma_{sc}(T \rightarrow 0)$, which corresponds to relaxation due to a vortex lattice, is about $0.05 \mu\text{s}^{-1}$. T_c of $\text{Cu}_{0.3}\text{Bi}_2\text{Se}_3$ lies close to the universal line for high- T_c cuprates and many other unconventional superconductors. It is known that indium in $\text{Sn}_{1-x}\text{In}_x\text{Te}$ acts as an acceptor and suppress the ferroelectric structural phase transition in SnTe . Above $x \sim 0.04$ the structural phase transition is completely suppressed and the system shows robust superconductivity. We have carried out a systematic investigation in $\text{Sn}_{1-x}\text{In}_x\text{Te}$ for a wide range of x . T_c and the relaxation rate σ_{sc} increase with increasing x . The T_c versus $\sigma_{sc}(T \rightarrow 0)$ plot of this system lies near the universal line. They are in a sharp contrast to Sr_2RuO_4 , which is another candidate for the topological superconductor. T_c of Sr_2RuO_4 is ~ 1.5 K, but it has a greater value of σ_{sc} by an order of magnitude.

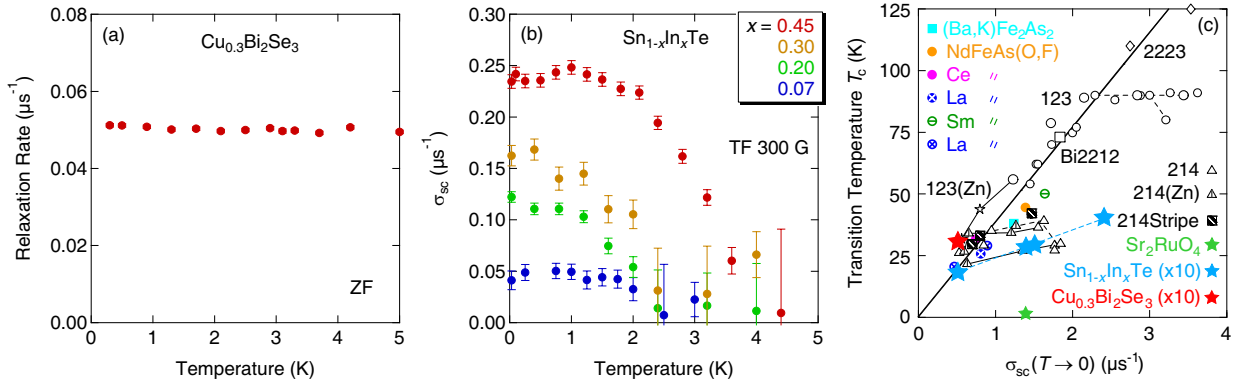


FIG. 1: (a) ZF relaxation rate for $\text{Cu}_{0.3}\text{Bi}_2\text{Se}_3$. (b) TF relaxation rate for $\text{Sn}_{1-x}\text{In}_x\text{Te}$. (c) A plot of $\sigma_{sc}(T \rightarrow 0)$ versus T_c for topological superconductors and other unconventional superconductors.