Muon mobility in white and grey tin

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Muon mobility has been studied by zero–field spin relaxation in both allotropes of tin. Motional reduction of the relaxation rate occurs rather abruptly between 40 and 70 K for normal white tin (β–Sn) while Mu^+ diffusion in grey tin (α–Sn) sets in only above 200 K. Although no computational modelling is available, one can speculate that the bond–centred positive ion Mu^+_{BC}, carrying a considerable lattice distortion, is responsible for the more sluggish onset of mobility in the diamond–like tetrahedral lattice of α–Sn. The sample of α–Sn was prepared as an

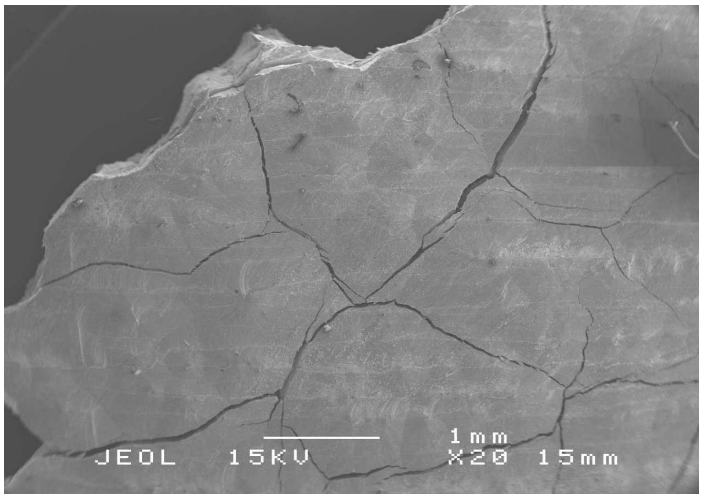

Fig. 1: Embrittlement during transformation of α–Sn to β–Sn

alloy with 1% Ge, to accelerate the difficult transformation and stabilize the low–temperature phase. Despite the very low electron density of ca. $10^{10}\,cm^{-3}$ (much the same as in intrinsic Si at room temperature), the diamagnetic fraction is 100% down to at least 4 K, confirming a result from the early μSR literature that no long–lived muonium states are formed. Nor is any enhancement of spin–exchange or Korringa relaxation detectable, longitudinal relaxation rates in 100 mT not exceeding a few inverse milliseconds at room temperature in either allotrope.