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Neutron scattering investigation of Tb^{3+} crystal fields in magnetoelastic TbSi

TbSi is an FeB-type compound exhibiting complex antiferromagnetic behavior with two first-order and one second-order phase transitions. Below 35 K, it exhibits a planar AFM structure then transitions into an incommensurate phase between 35 and 39 K before becoming commensurate again up to the Néel temperature, T_N = 57 K[1]. We measured the temperature-dependent crystal field softening, which is associated with the magnetic structure transition via powder inelastic neutron scattering measurements at ARCS, SNS. The polycrystalline averaged crystal field transitions from a gapped dispersion-like feature at T = 10 K to a smooth ungapped feature at T = 37 K, and paramagnet-like feature above 50 K. Magnetization measurements and heat capacity studies have shown a unique hysteresis of the magnetic transition[2], and we investigated the magnetic structure transitions via quasi-continuous heating neutron powder diffraction from T = 34 to 40 K at POWGEN, SNS.

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Topical Area

Hard matter: quantum, electronic, semiconducting materials

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