

## Simultaneous torsional oscillator and NMR study of solid $^3\text{He}$ - $^4\text{He}$ mixtures at low temperatures

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We have carried out simultaneous nuclear magnetic resonance (NMR) and torsional oscillator (TO) studies of  $^3\text{He}$ - $^4\text{He}$  solid mixtures in a cryogen-free dilution refrigerator. Extensive measurements on various samples with one hundred to a few hundred parts per million (ppm) of  $^3\text{He}$  in solid  $^4\text{He}$  using NMR/TO methods have been performed in the temperature range of from 1 K to 10 mK. Our double frequency torsional oscillator response appeared to be in very good agreement with previously measured data. Multiple frequencies allowed dynamical studies of  $^3\text{He}$ -impurities thus a good comparison with the relaxation times obtained from the NMR data. Different relaxation times corresponding to various 'states' of  $^3\text{He}$  within the  $^4\text{He}$  crystal have been found. Capability of long measuring times, due to the use of a cryogen-free cryostat, made it possible to study very long NMR relaxation times and time dependence of the response of TO.