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An RF-μSR Study of the 2-Norbornyl Radical in Norbornene

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Radio-frequency muon spin resonance (RF-μSR) has been used to investigate the temperature dependence of the hyperfine parameters of the 2-Norbornyl radical formed in polycrystalline norbornene. Working at a fixed RF frequency of 170.5MHz, field scans show striking changes in both the resonance line shape and amplitude as the temperature is scanned through the plastic phase, with the signal being lost in the brittle phase. Numerical fitting of the resonance spectra using Quantum [1] have allowed the hyperfine parameters to be determined. Data is compared to previous studies of the exo adduct using spin rotation [2] and avoided level crossing [3] measurements.

As part of the RF development programme at ISIS, we have been investigating the use of pulsed RF methods to manipulate spins to observe spin rotation signals from muoniated radicals. Compared to TF-μSR, pulsed RF techniques have the unique advantage of enabling slowly formed radical species to be measured. As a plastic crystal with internal dynamics, norbornene is an ideal test case. Results are presented demonstrating both a 90° rotation of the muon spin polarisation associated with the muoniated radical, and a clear free precession signal. Results obtained are discussed and the spin relaxation rate compared to data shown in reference 2.

[1] J.S. Lord, Physica B 374–375 (2006) 472–474.
[2] M. Ricco et al, J. Chem. Phys. 86, 4198 (1987)
[3] E. Roduner et al, Ber. Bunsenges. Phys. Chem 93 1194 (1989)

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