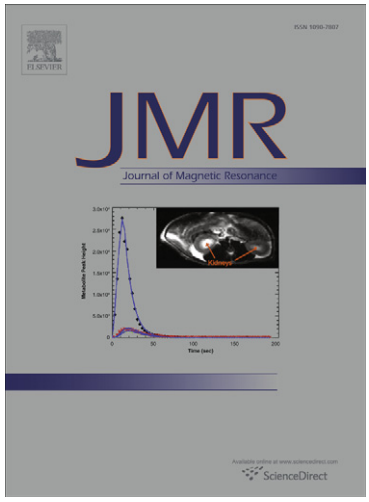

Effect of glassy modes on electron spin-lattice relaxation in solid ethanol

Dalibor Merunka, Marina Kveder, Milan Jokić, Boris Rakvin

PII: S1090-7807(12)00399-0
DOI: http://dx.doi.org/10.1016/j.jmr.2012.12.016
Reference: YJMRE 5138

To appear in: *Journal of Magnetic Resonance*

Received Date: 29 June 2012
Revised Date: 20 December 2012

Please cite this article as: D. Merunka, M. Kveder, M. Jokić, B. Rakvin, Effect of glassy modes on electron spin-lattice relaxation in solid ethanol, *Journal of Magnetic Resonance* (2013), doi: http://dx.doi.org/10.1016/j.jmr.2012.12.016

Effect of glassy modes on electron spin-lattice relaxation in solid ethanol

Dalibor Merunka*, Marina Kveder, Milan Jokić, and Boris Rakvin

Ruđer Bošković Institute, Bijenička cesta 54, HR-10000 Zagreb, Croatia

December 19, 2012

Electron spin-lattice relaxation (SLR) of TEMPO radical was measured in the crystalline and glassy states of deuterated ethanol in the temperature range 5-80 K using X-band electron paramagnetic resonance (EPR). The measured SLR rates are higher in the glassy than in crystalline state and the excess SLR rate in glassy state is much lower than in ethanol. This result suggests that extra modes in glassy state, i.e. glassy modes, produce the excess SLR rate via the electron-nuclear dipolar (END) interaction between the electron spin of radical and the matrix protons or deuterons. Using the soft-potential model and assuming the END interaction between the electron spin and the matrix protons, the contributions to SLR rate of various mechanisms of glassy modes were theoretically analyzed. The evaluations of SLR rates in glassy ethanol indicate two main mechanisms of glassy modes: thermally activated relaxation of double-well systems and phonon-induced relaxation of quasi-harmonic local modes. The SLR rates induced by these mechanisms correlate well with the experimental data.

Keywords: glassy state; electron spin-lattice relaxation; glassy modes; soft-potential model

*Corresponding author: Dalibor Merunka, Ruđer Bošković Institute, Bijenička cesta 54, HR-10000 Zagreb, Croatia; Tel: +3851-4561-136, Fax: +3851-4680-245, E-mail: merunka@irb.hr