Hyperpolarized 13C NMR lifetimes in the liquid-state: relating structures and T1 relaxation times

CHRISTOPHER PARISH, PETER NIEDBALSKI, University of Texas at Dallas, ZOHREH HASHAMI, LEILA FIDELINO, ZOLTAN KOVACS, Advanced Imaging Research Center, University of Texas Southwestern Medical Center, LLOYD LUMATA, University of Texas at Dallas — Among the various attempts to solve the insensitivity problem in nuclear magnetic resonance (NMR), the physics-based technique dissolution dynamic nuclear polarization (DNP) is probably the most successful method of hyperpolarization or amplifying NMR signals. Using this technique, liquid-state NMR signal enhancements of several thousand-fold are expected for low-gamma nuclei such as carbon-13. The lifetimes of these hyperpolarized 13C NMR signals are directly related to their 13C spin-lattice relaxation times T1. Depending upon the 13C isotopic location, the lifetimes of hyperpolarized 13C compounds can range from a few seconds to minutes. In this study, we have investigated the hyperpolarized 13C NMR lifetimes of several 13C compounds with various chemical structures from glucose, acetate, citric acid, naphthalene to tetramethylallene and their deuterated analogs at 9.4 T and 25 deg C. Our results show that the 13C T1s of these compounds can range from a few seconds to more than 60 s at this field. Correlations between the chemical structures and T1 relaxation times will be discussed and corresponding implications of these results on 13C DNP experiments will be revealed.

1US Dept of Defense award no. W81XWH-14-1-0048 and Robert A. Welch Foundation grant no. AT-1877

Christopher Parish
University of Texas at Dallas

Date submitted: 04 Nov 2015

Electronic form version 1.4