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Construction and ^{13}C NMR signal-amplification efficiency of a dynamic nuclear polarizer at 6.4 T and 1.4 K[1]

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Dissolution dynamic nuclear polarization (DNP) is a rapidly emerging technique in biomedical and metabolic imaging since it amplifies the liquid-state nuclear magnetic resonance (NMR) and imaging (MRI) signals by >10,000-fold. Originally used in nuclear scattering experiments, DNP works by creating a non-Boltzmann nuclear spin distribution by transferring the high electron (γ = 28,000 MHz/T) thermal polarization to the nuclear spins via microwave irradiation of the sample at high magnetic field and low temperature. A dissolution device is used to rapidly dissolve the frozen sample and consequently produces an injectable hyperpolarized liquid at physiologically-tolerable temperature. Here we report the construction and performance evaluation of a dissolution DNP hyperpolarizer at 6.4 T and 1.4 K using a continuous-flow cryostat. The solid and liquid-state ^{13}C NMR signal enhancement levels of ^{13}C acetate samples doped with trityl OX063 and 4-oxo-TEMPO free radicals will be discussed and compared with the results from the 3.35 T commercial hyperpolarizer.

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