Solid-state diffusion plays one of the most important roles in materials science. In particular, the precise measurement of ion dynamics in materials with structural disorder is of great interest. Spin-alignment echo (SAE) nuclear magnetic resonance (NMR), being comparable to exchange spectroscopy, turned out to be a powerful method to probe (ultra-)slow Li dynamics even in amorphous materials [1, 2]. However, $^7$Li Jeener-Broekaert echoes can be influenced by the simultaneous generation of dipolar with quadrupolar order. In many cases, the first can be suppressed by choosing proper evolution times $t_p$ of less than 20 $\mu$s [3].

Here, glassy Li$_2$Si$_3$O$_7$ served as a suitable model system to study the positive influence of isotope dilution on $^7$Li SAE NMR, i.e., the reduction of homonuclear dipole-dipole interactions through spatial separation of the spin-3/2 probe nuclei. Two samples, one with 100% $^7$Li and the other one with 5% $^7$Li (95% $^7$Li), were investigated by $^7$Li NMR line-shape analysis, spin-lattice relaxation NMR as well as mixing-time and preparation-time dependent $^7$Li SAE NMR using a 32-fold phase cycle. Jeener-Broekaert echoes and their Fourier transforms show that at sufficiently short $t_p$ the interfering dipolar interactions can be completely suppressed in that sample for which the proportion of $^7$Li was greatly reduced by substitution with $^6$Li. The so-obtained diffusion parameters are compared with results deduced from broadband conductivity spectroscopy.

References

