

“Watch” Epoxy Cure with TeachSpin’s Pulsed NMR

Pulsed NMR measurements of the spin-lattice and spin-spin relaxation times can give the experimenter a unique look into both the intra-atomic and molecular processes of a wide variety of condensed matter. Epoxies are now commonly used in both the research laboratory and the home, but the chemical process of curing or hardening is usually taken for granted. We suggest you consider the following experiment for an advanced undergraduate or graduate laboratory student. It requires only that the students be familiar with the PS1-B and know how to measure T_1 and T_2 rather quickly.

We measured T_1 using the “zero crossing” point where $T_1 = t/\ln 2$ and T_2 using both an eight pulse G-M sequence and the free-induction decay for short T_2 . Our data for the epoxy Eccobond 55 white, with Catalyst #9 in a ratio of 3g/0.4g is shown below.

There is certainly some interesting physics and chemistry here. Note that T_1 changed by a factor of 1.6 while T_2 changes 27 times more than T_1 . This is worthy of discussion and explanation. What’s going on here?

