QENS Study on Epoxy Resins with Different Network Structures

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Epoxy resin is a type of thermosetting resin with a three-dimensional cross-linked network. Because of their excellent mechanical strength, adhesiveness, heat resistance, chemical resistance, and electrical insulation, they are used in coatings [1], structural adhesives [2], fiber composite materials [3], and so on. For such applications, a problem of the epoxy resines is their mechanical brittleness. To improve the mechanical toughness, optimizing network structure is crucial. In our recent study, we have found that epoxy resins with lower cross-linking densities show higher toughness. In thiw work, to understand the microscopic origin of the mechanical properties, we have performed quasi-elastic neutron scattering measurements on epoxy resins with different cross-linking densities by using AGNES.

Fig.1 shows the dynamics structure factors $S(Q, \omega)$ for epoxy resins with a lower cross-linking density (red line) and higher cross-linking density (blue line) measured at 320 K (top) and 480 K (bottom). At 480 K, the epoxy resin with the lower cross-linking density exhbits a lager quasi-elastic broadening, suggesting a higher molecular mobility.

[1] H. Wei *et al.*, Composites Part B: Engineering, **193**, 108035 (2020).

[2] N. Sakata et al., Langmuir, 36, 10923 (2020).

[3] Y. Ma et al., Composite Structures, 160, 89 (2016).

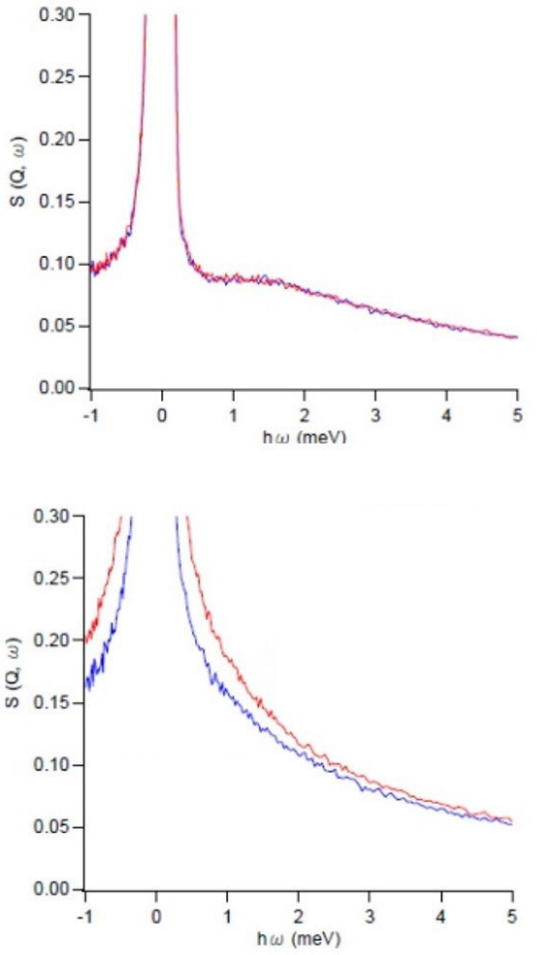

Fig. 1. Dynamics structure factors $S(Q, \omega)$ for epoxy resins with a lower cross-linking density (red line) and higher cross-linking density (blue line) at 320 K (top) and 480 K (bottom).