Local magnetic cluster size identified by neutron total scattering in site-diluted spin-glass Sn$_x$Fe$_{4-x}$N for x=0.88

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A detailed structure analysis for the site-diluted Sn$_x$Fe$_{4-x}$N (x = 0.25, 0.41, and 0.88) has been carried out through complex modeling of the neutron total scattering data. We present quantitative evidence showing the local ferromagnetic cluster size extending to ~8 Å on average when Sn$_{0.88}$Fe$_{3.12}$N undergoes the spin-glass transition (the other two not showing such transition). The modeling methodology used in this work involving the co-refinement of the nuclear and magnetic structure in both real and reciprocal space can potentially be applied generally to explore a variety of spin-glass material problems.

Fig. 1. Conceptual diagram showing the two different approaches for modeling the total scattering data.

References