REENTRANCE IN TRICRITICAL FIELD BEHAVIOUR OF DILUTED ISING METAMAGNET

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9.7 cm

Critical behaviour of diluted anisotropic antiferromagnets in a field is still a subject of discussion. Previous both experimental and theoretical works have suggested that there is a tricritical point (TCP), separating the temperature-field ($T-H$) phase space into a second-order ($T > T_{\rm TCP}$ and $H < H_{\rm TCP}$) and first-order ($T < T_{\rm TCP}$ and $H > H_{\rm TCP}$) transition regions. The TCP sustains until dilution reaches a certain value p_t, which has been argued to be equal or higher than the two-dimensional percolation threshold $p_c(d=2)$. At this concentration, beyond which no first-order transition can exist, the temperature $T_{\rm TCP}$ goes to zero while the field $H_{\rm TCP}$ remains finite. We have performed Monte Carlo calculations for the quenched site-diluted spin-$\frac{1}{2}$ Ising metamagnet with alternating ferromagnetic planes coupled antiferromagnetically. Our previous effective field calculations suggested that there might be a certain field region where the transition curve at a fixed value of the field crosses over from the second-order region to the first-order one and then again back to the second-order one (the reentrant phenomenon). Motivated by these calculations, our aim was to check the possibility of such a behaviour. We found indeed evidence of the first-order transition at concentration as low as $p = 0.6$ at a field intensity considerably lower than the tricritical field intensity $H_{\rm TCP}(p_t) = p_t z_2 |J_2|$ (z_2 is the number of nearest neighbours coupled with the central spin by $J_2 < 0$). This result strongly suggests that $H_{\rm TCP} - p$ curve is a double-valued function of H, i.e. a possibility of the reentrant phenomenon.

13.4 cm

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