

Investigation of $\text{LaMn}_{2-x}\text{Fe}_x\text{Si}_2$ ($0 \leq x \leq 1.2$) by Magnetic Measurements and Neutron Diffraction

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The various magnetic structures and phase transitions in the $\text{LaMn}_{2-x}\text{Fe}_x\text{Si}_2$ system have been thoroughly studied by X-ray powder diffraction, magnetic measurements and powder neutron diffraction. The substitution of Fe for Mn leads to a decrease in the lattice parameters and the magnetic interactions in the Mn sublattice cross over from a ferromagnetic character to an antiferromagnetic one. The magnetic structures of the $\text{LaMn}_{2-x}\text{Fe}_x\text{Si}_2$ compounds with $x = 0.2, 0.475, 0.5, 0.7$ and 1.0 have been determined between 2 and 450 K by neutron diffraction. A typical SmMn_2Ge_2 -like magnetic behavior is observed for the $x = 0.475$ sample. The magnetic phase transition from ferromagnetism to antiferromagnetism for this sample occurs at the intralayer Mn-Mn distance $d_{\text{Mn-Mn}} = 2.89 \text{ \AA}$. This value exceeds the well known corresponding threshold value $d_{\text{Mn-Mn}} = 2.87 \text{ \AA}$ in the pure Mn RMn_2X_2 compounds [1-2]. The results are summarized in the $\text{LaMn}_{2-x}\text{Fe}_x\text{Si}_2$ magnetic phase diagram [3].

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