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X-ray standing wave imaging of Mn in GaAs JORG ZEGENHAGEN, TIEN-LIN LEE, ISABELLE JOUMARD, ESRF, France, MARTIN BRANDT, WSI Munich, Germany, WLADIMIR SCHOCH, University Ulm, Germany — GaMnAs is a prototype of a dilute magnetic semiconductors with a Curie temperature T_c of up to 170 K at a Mn concentration of 5%. Substituting the Ga, the Mn acts as an acceptor with a local spin moment of 5/2 and ferromagnetic ordering is mediated by the itinerant holes. However, depending on the growth conditions and post-growth treatments, small fractions of the Mn may occupy magnetically inactive interstitial sites, act as a donor, compensating the hole doping, and thus decreasing T_c. Determining the site distribution of the Mn is therefore important in order to achieve an optimal T_c. We used x-ray standing waves generated by substrate (hkl) Bragg reflections to locate the Mn in the GaAs lattice for three differently treated samples, each with 4% Mn in a 4 nm thick epilayer. For 22 reflections, the amplitude as well as the phase of the (hkl) Fourier component of the Mn distribution were determined by recording the Mn K fluorescence during angular scans of the sample traversing the GaAs(hkl) Bragg peaks. Thus a real-space image of Mn within the GaAs unit cell can be reconstructed via direct Fourier expansion. The majority of the Mn is substituting for Ga, but refinement shows that up to 10% of the Mn occupies As interstitial sites.

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