

Neutron powder diffraction study of the CeScSi-type GdMgSn and GdMgPb compounds

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The magnetic structures of the CeScSi-type GdMgSn and GdMgPb compounds [1,2] were determined by combining powder neutron diffraction data using a flat plate geometry sample holder [3] and both ¹¹⁹Sn and ¹⁵⁵Gd Mössbauer spectroscopy measurements. The neutron powder diffraction patterns recorded in the paramagnetic state (T = 60 K), clearly shows the nuclear Bragg peaks of the CeScSi-type GdMgSn and GdMgPb compounds (figure 1). The appearance of purely magnetic peaks at 5.4 K in the angular range $4^\circ \leq 2\theta \leq 28^\circ$ is clearly observed (figure 1) and confirms the antiferromagnetic behavior determined by macroscopic magnetic measurements [4,5].

The neutron powder diffraction patterns recorded at 5.4 K (Figure 2) show many additional purely magnetic peaks which can be indexed by the propagation vector $k = [0.927, 0.088, 0]$ and $k = [0.892, 0, 0]$ for GdMgSn and GdMgPb, respectively, indicating an incommensurate antiferromagnetic structure. The 5.4 K neutron diffraction patterns can be refined using either an (*a,b*)-plane cycloidal magnetic structure or an (*a,b*)-plane sine-

wave modulated magnetic structure. ¹¹⁹Sn and ¹⁵⁵Gd Mössbauer spectra do not evidence broad absorption peaks indicating that there is probably no Gd³⁺ magnetic moment modulation in the structures. Thus, we can conclude to an (*a,b*)-plane cycloidal magnetic structure or an (*a,b*)-plane square-wave magnetic structure, which is not excluded even if any harmonic peaks are observed on the 5.4 K neutron powder diffraction patterns of these two CeScSi-type structure compounds.

References

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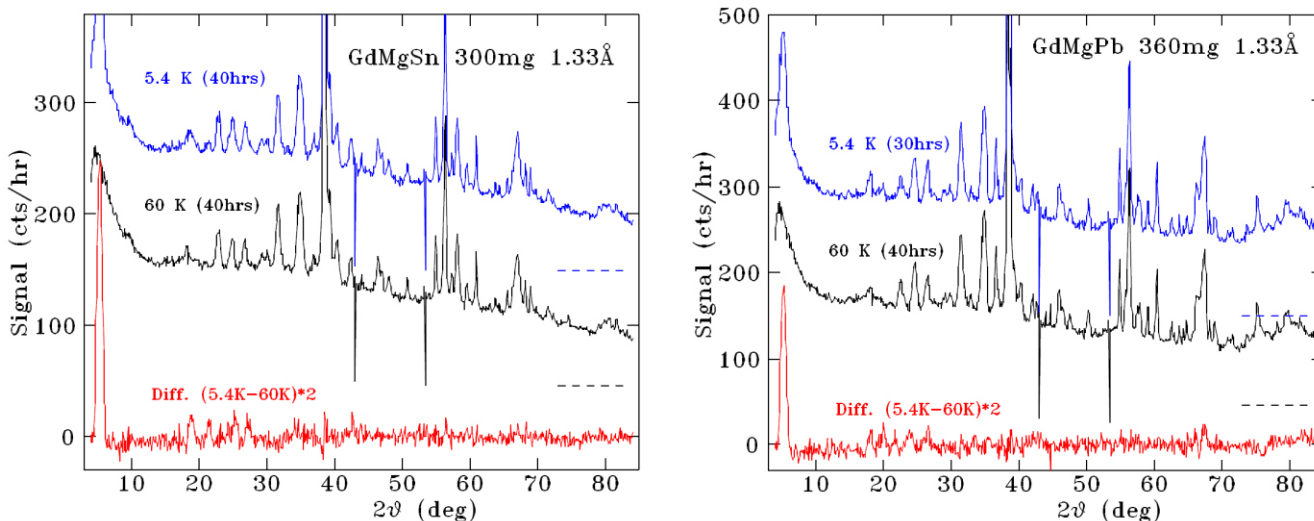


Figure 1 Neutron diffraction patterns of GdMgSn (left) and GdMgPb (right) at 60 K and 5.4 K, together with the difference between these two patterns.

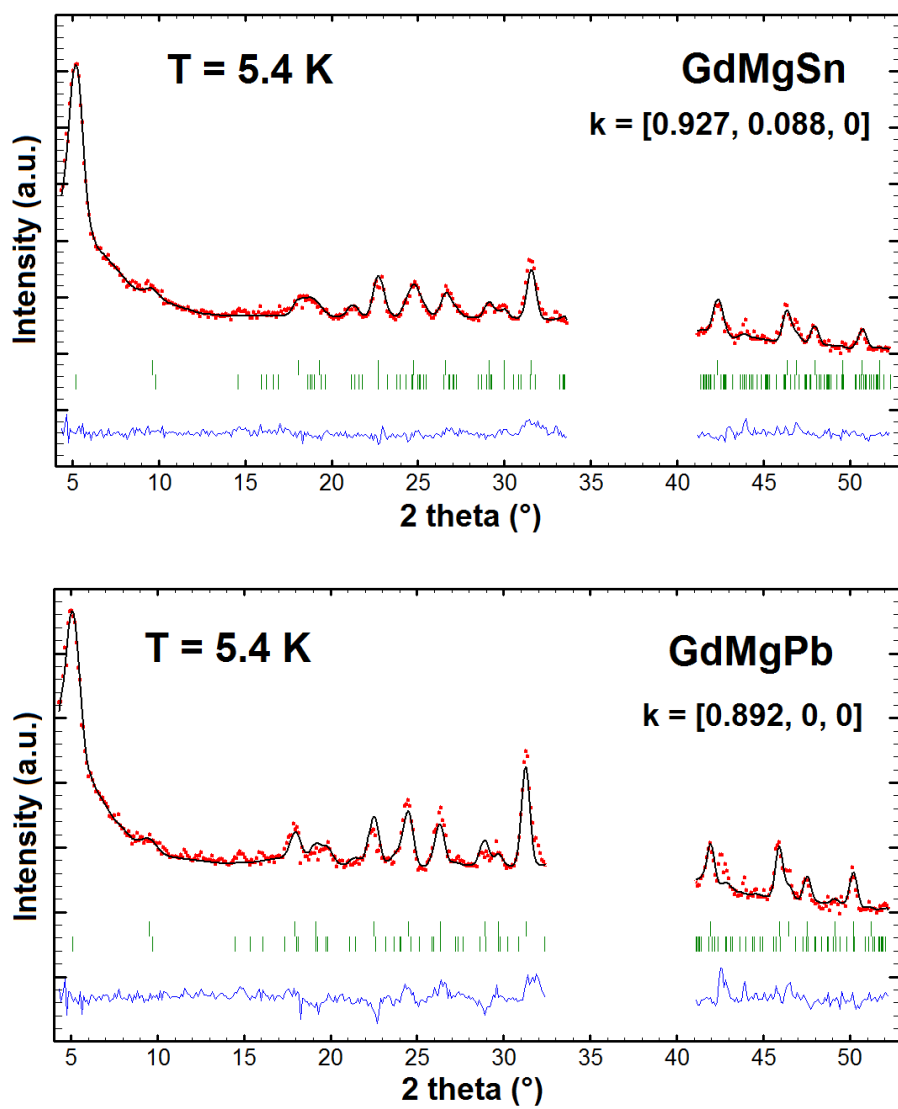


Figure 2 Refinement of the neutron powder diffraction patterns of GdMgSn and GdMgPb recorded at 5.4 K with $\lambda = 1.3286$ Å.