

A new example for a hydrogen induced insulating state in the La-Mg-Ni-H system

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Following our discovery of a hydrogen induced insulating state in the LaMg₂Ni-H system [1] we have investigated the closely related La₂MgNi₂-H system. Hydrogenation of tetragonal La₂MgNi₂ at 10 bar and 100°C leads to a complex metal hydride of composition La₂MgNi₂H₈ having monoclinic symmetry. In contrast to LaMg₂NiH₇ which displays tetradedral [NiH₄]⁴⁻ complexes that are isolated from each other, La₂MgNi₂H₈ displays two types of polyanionic hydrido complexes having novel geometries. The complexes are ordered and represent the first case of a mixed polyanionic metal hydride system in the literature. The Ni-H distances vary from 1.43 to 1.91 Å. Some hydrogen atoms are coordinated by La and Mg atoms only in octahedral [La₄Mg₂]-type or tetrahedral [La₂Mg₂]-type configurations. The hydride does not desorb hydrogen below 190°C and 1.10⁻¹ mbar pressure and segregates into LaH₃ and other unidentified phases above 300°C. Electrical resistivity measurements on powder samples confirm the hydride to be non-metallic.

[1] K. Yvon, G. Renaudin, C. M. Wei, M.Y. Chou, Phys. Rev. Lett. **94**, 066403 (2005)