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New intermetallic compounds in the Mg-Ni-Y system

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Although the Mg-Ni-Y system is considered to be one of the promising candidates for Ni-metal hydride batteries and an important metallic glass system, it has not been investigated experimentally for the whole composition range. In this work, this system has been investigated experimentally at 400°C and new findings have been incorporated in a self-consistent database using the CALPHAD approach. Diffusion couples and key alloys have been used to investigate this system. Phase relations and solubility limits have been determined for the ternary phases using EPMA and XRD techniques. Six new ternary compounds, Ä1 to Ä6, have been found in this system where Ä6 has been found to have wide solubility range. The crystal structures of these compounds are being investigated in this work. The binary compounds Ni_3Y and NiY are found to have similar solid solubility limits in the ternary system of approximately 2-3 at.% where Mg substitutes Y atoms. Whereas, the $MgNi_2$ compound forms ternary solubility where Y substitutes Ni atoms with maximum solubility of approximately 4 at.%. The isothermal section of the Mg-Ni-Y phase diagram at 400°C has been constructed using the current experimental results and compared with the literature. The constituent binary systems have been modelled using the modified quasichemical model for the liquid phase. The ternary compounds have been included in the modelling and a self-consistent thermodynamic database has been constructed for this system. The ternary intermetallic compounds with homogenity range have been modelled using the sublattice model.

Key words: Phase diagram, Diffusion couple, Thermodynamic modeling, Modified quasichemical model.