Structural and hydrogenation properties of RE-M-Mg compounds

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The purpose of the current work was to synthesize and investigate the hydrogen storage properties of ternary alloys from RE-M-Mg systems (RE-rare earth metals, M – transition element such as Ni and Cu). Alloys based on magnesium are known to store high amount of hydrogen (up to 7.7 wt.%) reversibly. Mg_2Ni-based alloys offer also very high capacity (up to 4 wt.% H_2). This storage capacity coupled with a low price and reversibility suggests that magnesium and magnesium-based alloys could be advantageous for use in battery electrodes and gaseous – hydrogen storage systems. Therefore, Mg-based and Mg_2Ni-based materials were in the focus of our studies.

The $REMg_2Cu_9$ ternary compounds (where RE – Y, La-Nd, Sm-Ho, Yb) [**1**] and $REMg_2(CuNi)_9$ alloys (where RE = La, Tb, Pr) were synthesised. Crystal structure determination and microstructural characterisation were performed.

$LaMg_2Cu_9$, $TbMg_2Cu_9$, $PrMg_2Cu_9$, $LaNi_5Cu_4Mg_2$ and $TbNi_3Cu_6Mg_2$ were chosen for the investigation of hydrogen storage properties. $TbMg_2Cu_9$ and $PrMg_2Cu_9$ did not absorb hydrogen in pressure range 1 to 10 bar and at the ambient temperature. $LaMg_2Cu_9$ absorbs 3 H/f.u (1.004 wt%) under 100 bar and at 25°C. $LaMg_2Cu_4Ni_5$ absorbs 1.6 H/f.u (1.002 wt%) under 10 bar and at 25°C. Pressure – hydrogen concentration isotherm was measured. $TbMg_2Ni_3Cu_6$ absorbs 3 H/f.u (1.004 wt%) under 100 bar and at 25°C. All the samples needed to be activated by heat treatment under vacuum followed by several absorption – desorption cycles.

[1] P.Solokha, V.Pavlyuk, A.Saccone, S.De Negri, W.Prochwicz, B.Marciniak, E.Rozycka-Sokolowska, Journal of Solid State Chemistry, 179 (2006) 3073-3081