Poster Presentation

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Structural Characterization of Mg_2CoH_5-based Nanocomposites for Hydrogen Storage

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Hydrogen is considered the ideal energy carrier, mainly due to its heating power, the highest among all chemical fuels, and to possibility of using it in fuel cells, therefore with efficiency and producing only water as by-product. However, the development of safe and effective hydrogen storage solutions remains as a challenge of applied research. MgH_2, Mg_2FeH6 and Mg_2CoH_5 complex hydrides are promising materials for hydrogen storage, avoiding the inconvenient of gaseous or liquid storage alternatives. The main attractives of these phases are their volumetric and gravimetric hydrogen capacities, their reversibility during absorption/desorption cycles and the relatively low cost. Recently, we have achieved an important control of the synthesis of Mg-based complex hydrides with nanocrystalline structure, using reactive milling (RM) under hydrogen atmosphere as processing route [1, 2]. In this study, we present new results concerning the synthesis, hydrogen storage properties and structural characterization of MgH_2–Mg_2CoH_5 nanocomposites prepared by RM. The nanocomposites were produced by milling different Mg-Co starting compositions (2:1, 3:1, 5:1, 7:1, 1:0) for 12 h in a planetary mill under 3 MPa of H_2. All samples were fully hydrogenated during milling, generating different MgH_2–Mg_2CoH_5 hydride mixtures. Mg presents the tendency of agglomerate during milling, so the sample that presents more MgH_2 shows larger agglomerates. This behavior causes a slight increase in the temperature of hydrogen desorption and the presence of two peaks, showed by DSC analysis for those samples which presents MgH_2 and Mg_2CoH_5. Using in-situ XRD and XANES during hydrogen desorption revealed that Mg and Co tend to remain coupled forming intermetallics after the complex hydride decomposition, differently from that was observed for Mg_2FeH6. This effect is correlated to the high-reversibility exhibited by the Mg_2CoH_5 phase. Furthermore, the nanocomposites of MgH_2+Mg_2CoH_5 showed better H-absorption/desorption kinetics than the Mg_2CoH_5 or MgH_2 alone, as shown by volumetric measurements. The combination of MgH_2 and Mg_2CoH_5 is therefore a promising strategy to produce hydrogen storage materials, matching the good reversibility and high capacity of magnesium hydride with the lower thermal stability.

[1] *D. R. Leiva, G. Zepon, A. A. C. Asselli, et al., International Journal of Materials Research, 2012, 09, 1147-1154,* ***[2]*** *D. R. Leiva, A. C. S. Villela, C. O. Paiva-Santos, et al., Solid State Phenomena, 2012, 170, 259-262*

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