Characterization and Hydrogen Storage Behavior of High Entropy Alloys of the Mg-Zr-Ti-Fe-Ni-Co system.

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High Entropy Alloys (HEAs) belong to a new class of metallic materials defined as alloys with a minimum of 5 metallic elements in equimolar ratios or varying from 5 to 35 at.%, where the entropy of mixing is larger than 1.61R. HEAs have drawing the attention of researches because the possibility to form single phases from multi-element systems. Several compositions of HEAs based on different multi-element systems have been reported in the last decade, with a vast variety of microstructures and properties (mechanical or functional properties). This work reports the processing and characterization of HEA alloys based on the Mg-Zr-Ti-Fe-Co-Ni system by two different routes: (i) Mechanical alloying by high energy ball-milling under inert atmosphere; and (ii) Reactive ball-milling under hydrogen pressure. The results show that some compositions when reactive ball-milled under hydrogen pressure form a multi-element FCC phase containing up to 1.2 wt.% of hydrogen. The same compositions when processed by high energy ball milling under inert atmosphere form a multi-element BCC phase. Sievert apparatus was used to study the hydrogen storage properties of these alloys. The results show that the FCC to BCC phase transformation accompanied by hydrogen desorption (up heating) is reversible, making these alloys very interesting for hydrogen storage purposes.