Influence of activated carbons derived from agricultural by-products on hydrogen storage characteristics of magnesium

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The mechanical activation method, along with an appropriate additive could resolve the drawbacks as sluggish hydriding/ dehydriding kinetics and high temperatures of hydrogen absorption and desorption of Mg. The addition of carbonaceous compounds to magnesium based composites prepared by ball milling enhances the hydrogen sorption kinetics. In consequence of these facts the present work discusses the hydrogen sorption properties of magnesium ball milled with activated carbon (AC) derived from agricultural by-products.

The absorption- desorption characteristics towards hydrogen of the composites 95wt.% Mg- 5wt.% activated carbon derived from bean pods and apricot stones obtained by ball milling under argon were investigated. Hydriding measurements were performed at temperatures 573 K and 473 K and P = 1 MPa and dehydriding at T = 623 K and P = 0.15 MPa. The absorption capacity values for the composites containing 5wt.% activated carbon derived from apricot stones and from bean pods at T = 573 K and P = 1 MPa are 5.5 wt.% and 3.2 wt.% after 1h of hydriding, respectively. The composite 95 wt% Mg -5 wt % AC derived from apricot stones were subjected to 80 cycles of hydriding/ dehydriding in order to investigate the change of hydrogen sorption properties and morphology during long cycling. This composite reached 6.25 wt% hydrogen absorption capacity at 40 cycles at 573 K and 1 MPa.

All investigated composites are characterized by X- ray diffraction analyses and scanning electron microscopy.

More pronounced positive effect on the hydrogen sorption properties showed the activated carbon derived from apricot stones. When the activated carbon additive has higher specific surface area, thus reflect favorably the hydrogen sorption kinetics. It appears that, some other characteristics of activated carbons, such as surface chemistry and porosity, also affect these processes. According to our results we can make the conclusion that the activated carbons object of this study can be used as suitable additives for magnesium based hydrogen storage materials.

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