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Hydrogen storage properties of TiFe + x%ZrMn2 (x = 2, 4, 8, 12) alloys

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Hydrogen is considered to be a good candidate to replace oil as an energy vector for mobile and stationary applications. Presently, the main ways to store hydrogen are in the liquid form at very low temperature or in gaseous state in high pressure tanks. However, these two techniques have serious limitations due to the low temperature and high pressure involved. There is thus the need to develop other means of hydrogen storage. Metal hydrides are considered to be good candidates to replace liquid and gaseous storage in many applications because the hydrogen could be stored in a compact way at low temperature and pressure. In a metal hydride the hydrogen is chemically bonded to metal atoms. We present here the effects of ZrMn2 on hydrogen storage properties of TiFe alloys prepared by arc melting. Compositions of the form TiFe+x%ZrMn2 (x = 2, 4, 8, 12) were studied. Each alloy is made of two phases: a primary phase with small amount of zirconium and manganese, and a secondary phase which has a higher proportion of zirconium and manganese than the primary phase. For both primary and secondary phases, when x increases there is substitution of iron by manganese and zirconium. We found that when x increases, the first hydrogenation is much faster and the alloy is getting more stable. Moreover, for x = 12, air exposure had a minimal impact on hydrogen sorption behavior. We can conclude that addition of ZrMn2 to TiFe greatly improves the first hydrogenation kinetics and improves the air resistance of the alloy.

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