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温度对Mg-3Ni-2MnO₂储氢材料吸放氢过程 相转变行为的影响

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摘要: 利用充氢反应球磨工艺制备氢化态Mg-3Ni-2MnO₂储氢复合材料, 测试材料的吸放氢动力性能, 并利用Avrami指数研究储氢材料吸放氢过程中相转变行为特征。结果表明: 在研究的温度范围内, 温度越高, 越有利于提高Mg-3Ni-2MnO₂储氢复合材料的吸放氢速度; 在150~200 °C范围内吸氢时, 其Avrami指数由初始阶段的1.0~1.5很快变为0.5, 即储氢材料很快进入已形成相的增厚阶段; 在150~200 °C范围内, 温度变化对吸氢相转变影响不大, 但影响相转变速率; 放氢过程中, 根据Avrami指数的变化, 相转变基本过程为形核长大阶段和新相继续稳定长大阶段(无新的晶核形成), 温度变化同样影响其放氢速率, 但对其放氢过程的相转变规律影响不大。

关键字: 储氢材料; 吸放氢; Avrami指数; 形核长大; 动力学

Effect of temperature on phase transformation behaviors of Mg-3Ni-2MnO₂ hydrogen storage materials during hydrogenation and dehydrogenation process

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Abstract: The hydrided Mg-3Ni-2MnO₂ hydrogen storage materials were fabricated through ball-milling under hydrogen atmosphere. The hydrogenation and dehydrogenation dynamic properties were measured. The Avrami index was used to study the phase transformation behavior character. The results show that in the range of temperatures selected, the higher the temperature is, the faster the hydrogenation and dehydrogenation velocities of the fabricated Mg-3Ni-2MnO₂ hydrogen storage materials are. When the materials is absorbed in the range of 150–200 °C, the value of Avrami index can change quickly from 1.0–1.5 in the initial period to about 0.5, indicating that this period is for the new phase to increase thickness quickly. The change of temperature has no obvious effect on the phase transformation behavior character whereas affects the

phase transformation velocity. During the dehydrogenation process, its phase transformation period includes nucleation and growth, and steady growth of the new phase with no new crystal nucleus appearing, according to the change of Avrami index. The change of temperature also affects the dehydrogenation velocity and has no obvious effect on the phase transformation behavior character.

Key words: hydrogen storage materials; hydrogenation and dehydrogenation; Avrami index; nucleation and growth; dynamics

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