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Martensitic transformation, phase constitution, microstructure and damping properities of rapidly solidified binary Fe-17%Mn alloy

N Yan and B Wei
Northwestern Polytechnical University, China

Discovery of shape memory effect in Fe–Mn based alloys undergoing non-thermoelastic γ→ε martensitic transformation raise a possibility that the alloys can absorb mechanical energy by internal friction. It posses the combination of a pronounced damping capacity and good mechanical properties and have been the subject of many investigations as part of a particular interest in high damping alloys for engineering applications. Thus, the high damping Fe-17%Mn alloy can be widely applied to household appliances, automobiles, industrial facilities and power plant components with its excellent damping capacity (specific damping capacity of 30%) and mechanical property (an ultimate tensile strength of 700 MPa). The Fe-Mn based alloys are successfully used in stone cutting machines, where the reduction in noise achieved in 10-25 dB. The damping capacity in Fe-Mn based alloys is generally attributed to ε martensite and stacking faults together. In the present work, the aim is to investigate the martensitic transformation, phase constitution, microstructure and damping properities of Fe-17%Mn alloy prepared by thin strip casting and free fall processing. The variation of strip thickness is found to have a large effect on the phase constitution, microstructure and damping property of the alloy. Heat treatment of the thin strips enhances the damping property with temperature and strain, remarkably. The influence of difference in cooling rate and undercooling of rapid solidified droplets on the martensitic transformation and microstructure is also demonstrated. Both the martensitic transformation temperature Ms and inverse martensitic transformation temperature increases with the decrease in droplet diameter. The microstructure is composed of much refined (Fe) dendrites.

yanna@nwpu.edu.cn

Microwave assisted hydrothermal synthesis of MoS_2/SnO_2 nanocomposites for use in supercapacitors

Nguyen Thi Xuyen[1] and **Jyh Ming Ting**[1, 2]
[1]National Cheng Kung University, Taiwan

Two–dimensional (2D) transition metal dichalcogenide materials attracts a huge attention for application energy storage devices due to its unique nano-construction and electronic properties. In this study, molybdenum disulfide (MoS2), flower-like particles consisting of 2D nanosheets, have been synthesized using a microwave-assisted hydrothermal method under various conditions. The obtained materials were characterized for the material properties and then made into electrodes for supercapacitor assembly. The resulting supercapacitor was evaluated using cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and a charge-discharge technique. The CV measurement showed that as-synthesized MoS_2 electrode delivered a capacitance as high as 234 Fg^{-1} at a scan rate of 5 mV/s in KCl aqueous electrolyte. MoS_2 electrode also exhibited excellent electrochemical performance of high conductivity based on the EIS analysis. Further enhancement of the electrochemical performance has been achieved through the growth of SnO_2 nanoparticles on the MoS_2. The SnO_2, not only provided additional pseudo capacitance, but also served to further separate the 2D MoS_2 nanosheets. The effect of materials' characteristics on the electrochemical performance is addressed.

nguyenxuyen1511@gmail.com