ELECTRONIC PROPERTIES OF NANOCRYSTALLINE AND POLYCRYSTALLINE $TiFe_{0.25}Ni_{0.75}$ ALLOYS

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Nanocrystalline and polycrystalline $TiFe_{0.25}Ni_{0.75}$ alloys were prepared by mechanical alloying (MA) followed by annealing and arc melting method, respectively. Results on XRD during MA showed that the originally sharp diffraction lines of Ti, Fe, and Ni gradually become broader and their intensity decreases with milling time. The powder mixture milled for more than 30 h has transformed completely to the amorphous phase, without formation of an other phase. Formation of the nanocrystalline alloy was achieved by annealing the amorphous material in high purity argon atmosphere at 970 K for 0.5 h. The size of amorphous powder grains was of the order of 20 nm; they have a tendency to agglomerate. The mean crystallite sizes of MA and annealed material were less than 35 nm. The mean crystallite sizes of the arc melted and homogenised sample were less than 1000 nm. XPS studies showed that the shape of the valence band measured for the polycrystalline $TiFe_{0.25}Ni_{0.75}$ alloy is practically the same compared to that reported earlier for the single crystalline sample. On the other hand, the XPS valence band of the MA nanocrystalline $TiFe_{0.25}Ni_{0.75}$ alloy is considerably broader compared to that measured for the polycrystalline sample. This is probably due to a strong deformation of the nanocrystals. The modifications of the electronic structure of the nanocrystalline alloy could significantly influence on its hydrogenation properties.
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