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THE EFFECT OF Ti ADDITION ON MICROSTRUCTUREAND MAGNETIC PROPERTIES OF NANOCRYSTALLINEFeAl40 ALLOY POWDERS PREPAREDBY MECHANICAL ALLOYING

N.METIDJI, N-E.Bacha, A.Younes

Abstract: Recent research on nanocrystalline FeAl alloys has shown that these alloys are of high importancedue to their promising structural and mechanical properties, particularly magnetic behavior. Thiswork aims at studying the synthesis, structural and magnetic characterization of nanocrystallineFeAl alloy powders, prepared by a mechanical alloying process (MA), as well as the effect of Tiaddition on the magnetic properties of a compound. The powder morphology, phase transformation,crystallite size, micro-stress evolution, and magnetic properties were investigated by X-raydiffraction (XRD), scanning electronic microscopy (SEM), and vibrating samples magnetometer(VSM). It has been found that at the final stage of mechanical alloying the bcc-disordered FeAlphase and nanocrystalline Fe(Al, Ti) solid solution occurred for the FeAl40 and FeAl40Ti3 alloys,respectively. The milling time and the addition of titanium affect the powder morphology anddecrease the size of the particles. The average crystallites size of 17.2 and 11.2 nm was reached atthe end of 30 h of milling, and the lattice strain increased up to 0.3 and 0.21% for the FeAl40 andFeAl40Ti3 alloys, respectively. Also, the magnetic properties attributed to microstructural changeswere investigated. It has been established that the change in magnetic behavior occurs mainly due tothe formation of a supersaturated Fe(Al, Ti) solid solution. Magnetic properties of the samples arehighly influenced by the addition of the Ti element into FeAl40 alloy, as well. The magnetism of theFeAl40Ti3 compound is reported to be higher than that of FeAl40.

Keywords : Mechanical Alloying, nanocrystalline materials, lattice strain, crystallite size, magnetic behavior.