VARIATION OF THE MAGNETIC PROPERTIES OF α - Fe AND Cr 25% - TYPE STEEL ALLOY WITH PLASTIC DEFORMATION

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The magnetic properties of two different microstructures of α-Fe and Cr 25%-type steel alloy are measured as a function of plastic deformation. Magnetic susceptibility, coercivity and magnetic anisotropy are determined for strains up to 12%. In martensite samples it is found that the initial magnetic susceptibility, χ_a, the maximum magnetic susceptibility, χ_{max}, and the magnetic anisotropy energy, K, are increased with the degree of plastic strain. This was attributed to the reduction of dislocation density in some volumes of the martensite matrix during the early stage of deformation. Further increase in dislocation density in the matrix during the later stage of deformation, affects the average value of the strength of interaction between the domain wall and dislocation, thus contributes to the decrease in magnetic susceptility and magnetic anistorpy. Correlations are found between maximum magnetic susceptibility and coercivity and also between magnetic anisoropy and initial magnetic susceptibility with the plastic strain deformation.

1. Introduction

Considerable interest has been focused on the effect of internal stress and microstructural parameters, such as grain size [1,2], composition, and texture [3,4], on the behaviour of magnetic domain wall motion in ferromagnetic material. The most important example in this respect are the considerable changes of structure sensitive magnetic properties of some α- Fe steel with microstructure and plastic deformation[3]. Attempts have been made to explain this in terms of the inhomogeneity in the lattice continuity by the formation of ferrite-cementite lamellae and pearlite-austenite interfaces in quenched α-Fe effectively limiting the reversible and irreversible displacement of magnetic domain walls [3-5]. Since the formation of cementite lamellas, beside the dislocation density, may have an important role in controlling the domain wall dynamics [3], it is the aim of this work to make basic study of structure