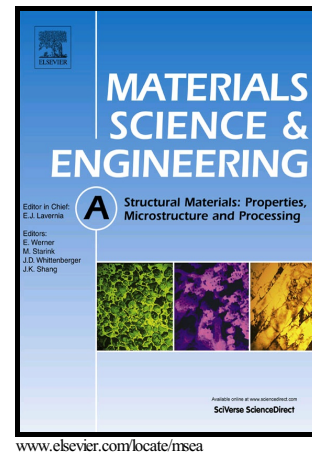


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The Influence of Magnetic Field on the Mechanical Properties & Microstructure of Plain Carbon Steel

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Abstract: The influence of magnetic field on the mechanical properties and microstructure of 0.56%C plain carbon steel specimens is studied experimentally. Specimens have been subjected to magnetic field intensities: 400 Oe, 600 Oe, and 800 Oe. The results reveal that the modulus of elasticity and the ductility are decreased. While, no significant change in the hardness and the microstructure is observed.

Keywords: Plain Carbon Steel - Mechanical Properties - Hardness – Microstructure – Magnetic Field.

Introduction

Recently, many researches have been conducted on the possibility of changing the properties and structure of metals under the effect of magnetic field [1-5]. The modulus of elasticity and Poisson's ratio of electrical engineering steel showed a slight increase under the influence of 400 Oe magnetic field intensity; however, no noticeable change in the properties of structure steel 45 was observed under the same magnetic field intensity [6]. Additionally, the effect of magnetic field on heat treated carbon steel was studied[7]. It was found that the yield strength decreased by 3-5%, while the ductility increased by 5-15%. Furthermore, the hardness of high speed steel increased under the effect of 700-800 Oe magnetic field intensity[8]. The Vickers hardness of steel of 1wt%C containing Mn and/or Cr increased by approximately 2-8% when a 50 T/m magnetic field gradient was applied and the hardening value varied with the chemical composition[3]. While, the microstructure of heat treated carbon steel showed some changes under the effect of magnetic field, the elongation of the α ferrite particles was observed in the direction of the applied magnetic field(12 T)[9].

In this research, the change in tensile properties, hardness, and microstructure of plain carbon steel under the influence of steady magnetic field of intensities 400, 600, and 800 Oe has been reported.

Experimental work

To generate a magnetic field with variable intensities, a specially designed magnetic field coil was constructed, and connected to adjustable direct current (DC) source, to obtain magnetic field intensities (H) from 0-1000 Oe, as shown in Figures 1 and 2. The magnetic field intensity (H) was measured and calibrated by F.W. Bell Gauss meter model 4048, with accuracy 2%.

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