

THE INFLUENCE OF CARBON AND HYDROGEN IMPURITIES ON MAGNETIC PROPERTIES OF NANOCRYSTALLINE NICKEL PRODUCED BY GRINDING IN THE BALL MILL

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Introduction

The methods founded on intensive mechanical action on worked material are of frequent use for production of nanocrystalline materials. One of these methods is the method of mechanical treatment in ball mills of different types. During large times of mechanical treatments necessary for production of nanocrystalline materials in ball mills the penetration of metal atoms from ball mill's details and of oxygen, carbon and hydrogen impurities from the working medium may occur into the worked materials.

Results and discussion

In present work for fabrication of nanocrystalline nickel the ultrasonic vibrations were induced in working camera of ball mill, and despergation process was carried out at the imposition of alternating magnetic field. The ethanol was used for working medium, the despergation time was changed from 1 to 30 hours.

X-ray investigations were carried out on diffractometer HZG-4 with the use of Cu k_{α} -radiation. The magnetic measurements were realized using the ballistic magnetometer over a range of fields up to 800 kA/m in the temperature interval from 77 to 650K. The parameters of crystalline lattice and microstresses in powders

were defined by the Sherer and Viljamson – Holl methods. The sizes of particles and their conglomerates were defined with the scanning erelectron microscope “Kemscan”.

The received experimental results indicate that structural state and magnetic properties of nickel powders, worked in ball mill, undergo essential changing. It was showed that as the mechanical treatment time increases simultaneously with the reduction of saturation magnetization, a decrease of sizes of coherent scattering fields occurs also with increasing of microstresses and parameter of Ni crystalline lattice.

Conclusions

It has been found that decreasing of sizes of coherent scattering fields and an increase of microstresses are caused by the direct mechanical action on the materials being worked. This results in essentially crushing of microstructure and an increase of density of crystalline structure defects. In contrast to this the changes of lattice parameter of nickel and its saturation magnetization are conditioned mainly by the influence of hydrogen, carbon, oxygen impurities, which enter in working medium composition and penetrate in particles of powders in process of their mechanical treatment.