HARDNESS OF SINTERED SAMPLES WITH MICROGRADIENT STRUCTURE

MIRIAM KUPKOVÁ*[a], ADAM ZELEŇÁK[a], RENÁTA ORIŇÁKOVÁ[b]

[a]Institute of Materials Research of SAS, Watsonova 47, Košice, Slovakia, [b]Institute of Chemistry, Faculty of Science, P. J. Šafárik University in Košice, Košice, Slovakia

mkupkova@imr.saske.sk

Keywords: iron powder microparticles, copper coating, hydrocarbon coating, microstructure, microhardness

Surface of iron powder particles was electrolytically coated with a layer of Cu and then with a layer of C_nH_m. Obtained powders were pressed into cylindrical samples and sintered. The compacting pressure was 600 MPa and sintering temperature 1120^0C. The evolution of microstructure caused by sintering and hardness of sintered samples were investigated. A microgradient structure of sintered samples prepared from coated powders was observed. There were cores of original iron powder particles, almost unaffected by sintering, and regions around consisted of the Fe-Cu solid solution and/or pearlite. The Vickers microhardness (HV 0.01) of samples has been investigated using a micro hardness tester LECO LM-700AT. For each sample, 300 indents were performed. Microhardness measurements made at different points of the specimen enabled us to study the distribution of hardness values throughout the sample and to determine the range for these values, which reflects the multiphase microstructure of the examined material.

For the samples from a pure iron, the range (interval) of observed microhardness values is narrow and the frequency of occurrence of a given value reveals a clear peak at the value of 152 HV 0.01 (Fig. 1a). For samples from an iron powder coated with a copper, the range of observed microhardness values spreads to the region of higher values, beyond the range for a pure iron, and the frequency of occurrence of a given hardness value becomes more wider without clear peak (Fig. 1b). This corresponds to the creation of a quasicontinuous microgradient structure, with concentration of Cu increasing from the core of iron grain towards to its periphery, and strengthening of the material due to formation of solid solution and precipitation of Cu within Fe matrix. For samples from an iron powder coated with a copper and C_nH_m, the range of observed microhardness values is widest from the samples investigated here and covers the highest measured values (Fig. 1c). This is caused by the fact that in addition to the strengthening due to solid solution and precipitation by Cu, the Fe/Cu/C_nH_m samples are also affected by creation of pearlite and porosity.

Additionally, the apparent hardness HV10 of sintered samples was determined (Fig. 2). The properties of Fe/Cu/C_nH_m systems were found better than those of the Fe and Fe/Cu systems. Values of HV0.01 and HV10 differ due to the indentation size effect.

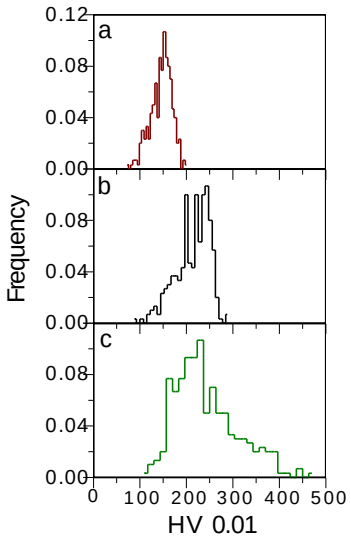

Figure 1. **Microhardness vs. frequency of occurrence**

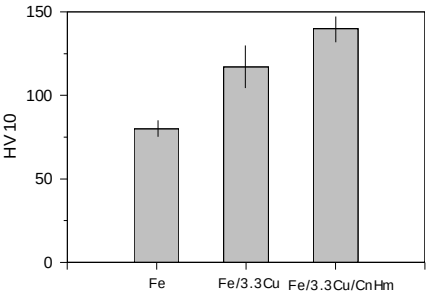

Figure 2. **The macro Vickers hardness values HV10 .**

Acknowledgments - The autors thank for financial support of the research by the Slovak Research and Development Agency under contract APVV No. 0677-11 and VEGA grants 2/0168/12, 1/0211/12 of the Slovak Grant Agency