

FEATURES OF MAGNETIZATION OF FERROMAGNETIC COMPOSITES: ROLE OF GRAIN CHAINS ON AN EXAMPLE OF GRANULATED MEDIA

D.A. Sandulyak¹, A.A. Sandulyak¹, M. N. Polismakova¹, A.V. Sandulyak¹,
I.A. Solovev¹, A.P. Dwivedi^{*2}, C.C. Dumanidis²

¹MIREA — Russian Technological University, Moscow, Russia

²Guangdong Technion-Israel Institute of Technology, Shantou, China, *anand.dwivedi@gtiit.edu.cn

Abstract: The purpose of the article is to develop a model of chain-by-chain magnetization of granular media, in which chains of granules are basic elements. When a granular medium is magnetized, such as when consisting of ferromagnetic spheres, the chains of contacting granules (spheres) serve as self-sufficient conductors of the magnetic flux Φ . Each of these chains is characterized by a pronounced redistribution Φ in its cross section. If in the chain of spheres with radius R the conditional core with radius r is selected and for measurements Φ to surround its loop placed between the contacting spheres, then an increase in r decreases the thread density (magnetic induction B). According to Φ , detailed information on B in the cores and their magnetic permeability μ with the magnetization of the chains in the solenoid is obtained.

Keywords: Magnetic Permeability, Magnetic Flux, Granulated Medium, Grain Chains.

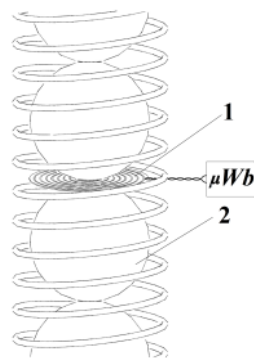


Fig.1. A chain of spheres 2 (located in solenoid) with a circular loop-sensor 1 connected to the microwebermeter

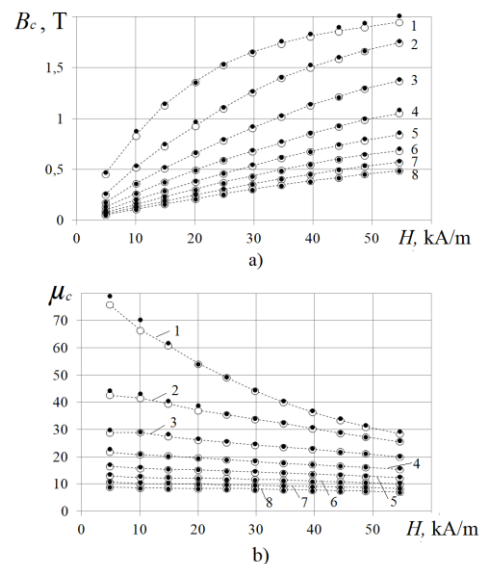


Fig.2. Magnetic induction B_c data (a) and magnetic permeability μ_c (b) for different (r/R) cores of chain of spheres in the dependence from intensity of the magnetizing field H : 1 – $r/R=0.2$; 2 – 0.3; 3 – 0.4; 4 – 0.5; 5 – 0.6; 6 – 0.7; 7 – 0.8; 8 – 0.9. Shaded (•) and not shaded (○) points belong to chain of spheres with a radius $R = 15$ mm and $R = 20$ mm accordingly

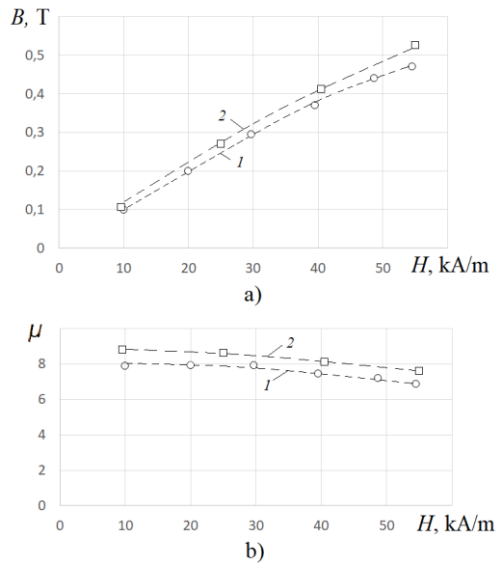


Fig.3. Field dependencies of magnetic induction B (a) and magnetic permeability μ (b): 1 – for chain of spheres (at $r_c/R=0.9-1$); 2 – for polyball media

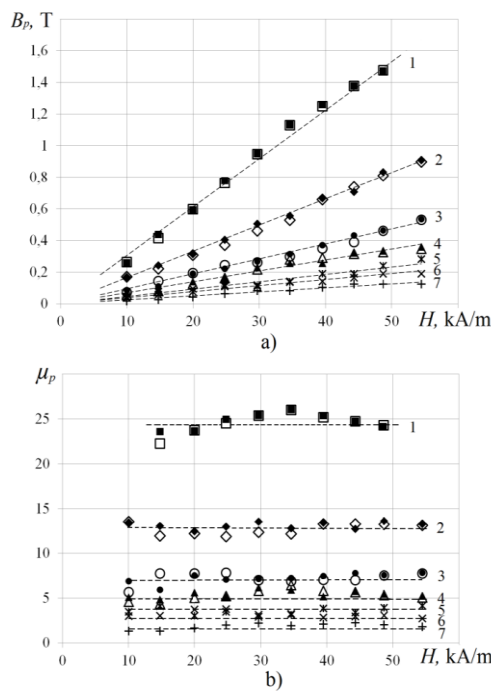


Fig.4. Magnetic induction B_p data (a) and magnetic permeability μ_p (b) for different relative radius of pipe "layer" of chain in the dependence from intensity of the magnetizing field H : 1 – $r_p/R = 0,25$; 2 – $0,35$; 3 – $0,45$; 4 – $0,55$; 5 – $0,65$; 6 – $0,75$; 7 – $0,85$. Shaded ($\blacksquare, \blacklozenge, \bullet, \blacktriangle$) and not shaded ($\square, \diamond, \circ, \triangle$) points of dependences 1-4 belong to chain of spheres with a radius $R = 15$ mm and $R = 20$ mm accordingly; points ($\times, \times, +$) of dependences 5-7 are common for $R = 15$ mm and $R = 20$ mm