P-43

Influence of the crystalline microstructure on the magnetic ordering of nanocrystalline chromium

D. Wardecki[1]*, R. Przeniosło[1], M. Bukowski[2], R. Hempelmann[2], A. N. Fitch[3] and P. Convert[4]

[1]*Faculty of Physics, University of Warsaw, Hoża 69, 00-681 Warsaw, Poland*
[2]*Institute of Physical Chemistry, University of Saarbrücken, D66123, Saarbrücken, Germany*
[3]*European Synchrotron Radiation Facility, BP 220 F-38043, Grenoble Cedex, France*
[4]*Institute Laue Langevin, BoîtePostal 220 F-38043, Grenoble Cedex, France*

Keywords: nanocrystalline chromium, magnetic ordering, neutron diffraction, synchrotron radiation diffraction

*e-mail: dward@fuw.edu.pl

The combination of two powder diffraction techniques: neutron diffraction as well as synchrotron radiation (SR) diffraction was used in order to study the influence of the microstructure of nanocrystalline chromium (n-Cr) on its magnetic ordering.

The characterization of the n-Cr microstructure was performed by using the Warren-Averbach method [1] with SR data. It was shown that the average crystalline size D for the studied samples of n-Cr varies in the range from 29 nm up to 65 nm, whereas the related microstrain fluctuations Δd/d are in the range of 0.39 – 0.13%, respectively [2]. The parameters of the log-normal distributions of the crystallite sizes were calculated as well (see Figure 1a).

The analysis of the magnetic Bragg peaks intensities in the studied n-Cr samples allowed to determine the type of magnetic ordering in each n-Cr sample as well as the contribution of the particular magnetic phases.

In our model we assumed that the smallest crystallites have only the antiferromagnetic phase (AF_0). The question which arises form this approach is: what is the critical size of the crystallites that have only the AF_0 phase? As it is shown in Figure 1b the values of the cumulative distribution function G(V) can be related to the contribution of the antiferromagnetic phase m_{AF0}. From this comparison it is possible to determine the critical size which is similar for all studied samples of n-Cr and its average values is D_C = 18±2 nm [3].

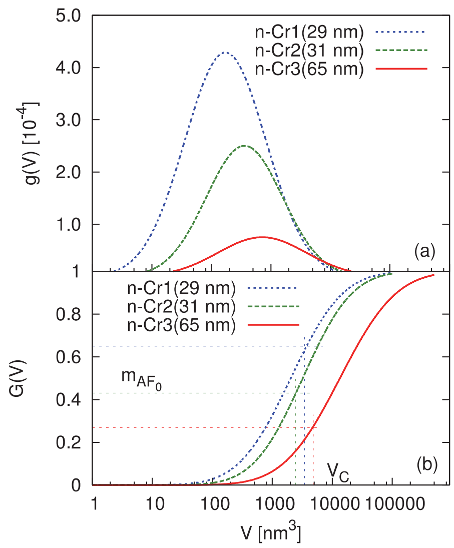

Figure 1. Log-normal distribution function g(V) (a) and the cumulative distribution function G(V) (b) for three n-Cr samples.

Acknowledgments: This work has been supported by the Ministry of Science and Higher Education (Poland) under Projects No. 458/1/N-ILL/2010/0 and No. 155/ESR/2006/03, respectively.

[1] B. Warren, B. Averbach, *J. App. Phys.* **21** (1950) 595.
[2] D. Wardecki, R Przeniosło, A Fitch, M Bukowski and R. Hempelmann, *Journal of Nanoparticle Research* **13** (2011) 1151.
[3] D. Wardecki, R. Przeniosło, M. Bukowski, R. Hempelmann, A. Fitch, P. Convert, *Phys. Rev. B* **86** (2012) 064410.