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Letters to the Editor

SLOW MOTION OF DOMAIN WALLS AT LIQUID NITROGEN TEMPERATURE

MICHAL KONČ*, OTO DUŠA*, Košice

The slow motion of domain walls creep has been intensively studied in the past few years. However, as regards the temperature dependences of the effect creep we have come across two works only, one published by Sweet [1], who studied the slow motion of domain walls on the PY 82 samples in the temperature interval 8.9—81.7 °C, the other published by Kanavina et al. [2], who also studied permalloy thin films in the range of 20—200 °C. To obtain a more detailed information about the course of the creep at lower temperatures and also to gain an insight into the mechanism of this effect we decided to observe it at liquid nitrogen temperature and to compare the results with those obtained at room temperature.

The used magneto-optic method adapted for measurements at liquid nitrogen temperatures was described in [3] and the measuring method in [4]. The samples were vacuum deposited on a glass slide at a pressure of 5×10^{-6} torr. The uniaxial anisotropy was produced by inclinating the substrate. The composition of the sample was 79 % Ni, 16 % Fe and 5 % Mo. The coercitive force H_c of the samples was between 0.7 and 1.3 Oe and the anisotropy field H_K was in the range 5—7 Oe.

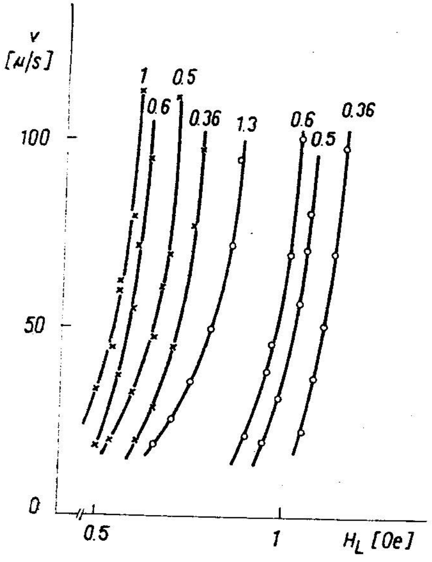

Fig. 1. The dependence of the domain wall velocity v upon the external dc magnetic field H_L. The parameter is the external ac magnetic field H_T. The figures at each curve give its value in Oe. O — at liquid nitrogen temperature; X — at room temperature.

Fig. 1 shows the dependences of the domain wall velocities upon the external dc magnetic field in the easy axis H_L for a typical sample from this set, obtained at room and liquid nitrogen temperatures. The parameter is the external ac magnetic field H_T. All dependences show an exponential character over the measured range. In Fig. 2a and 2b the experimental critical curves for the wall motion together with the curves of the constant velocities for the same sample are presented in the H_L, H_T plane. The coercitive force of the wall H_W increased at the liquid nitrogen temperature by one third. The curves of the constant velocities remained almost equally shifted with respect to the curve of the wall coercitive force, indicating that the creep efficiency decreased at liquid nitrogen temperature. We have deduced from these results that the mechanism of the creep onset does not change under these conditions. Only the distribution of the local critical fields varies, which contributes essentially to the decrease in the creep efficiency.

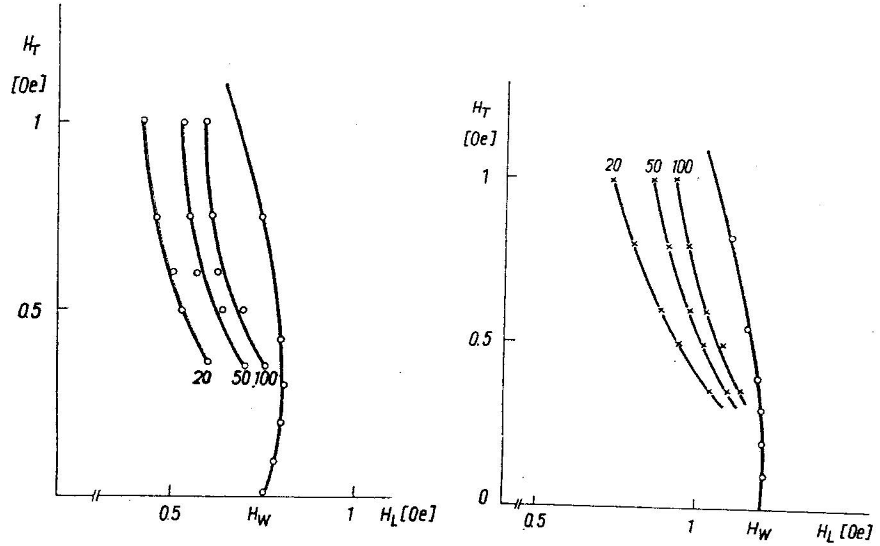

Fig. 2. The curves of the constant velocities with the critical curve for the wall motion observed at: a. room temperature; b. velocities with the critical curve for the wall motion observed at: a. room temperature; b. liquid nitrogen temperature.

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* Katedra experimentálnej fyziky Prírodovedeckej fakulty UPJŠ, 041 54 KOŠICE, nám. Februárového víť. 9.

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