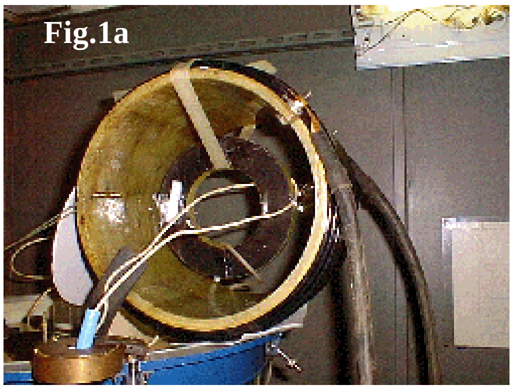
LIA Core Magnetization in Fringe Magnetic Field

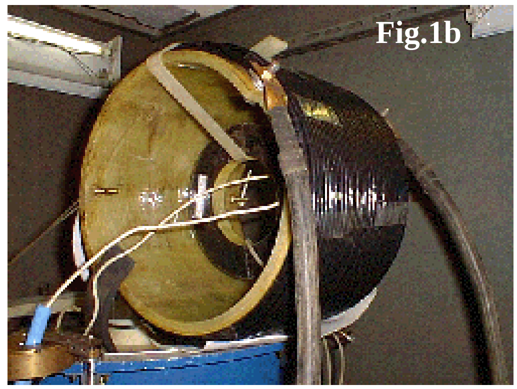
S. Mamaev, S, Putchkov, G. Mamaev
MRTI RAS, Moscow, Russia

January, 2000

To find how fringe magnetic field can affect tape wound core magnetization properties, a test that is described in this note was performed at MRTI.

Magnetic field was created by the solenoid shown in Fig. 1a and b. The solenoid was 300 mm in diameter and 300 mm in length.





There were 165 turns in the solenoid. At current level of 50 A, flux density in the center of the solenoid was 0.027 T, and it was directed along the solenoid axis. Toroidal core 190x110x20 mm^3 made from 2HCP alloy was placed in the center of the solenoid.

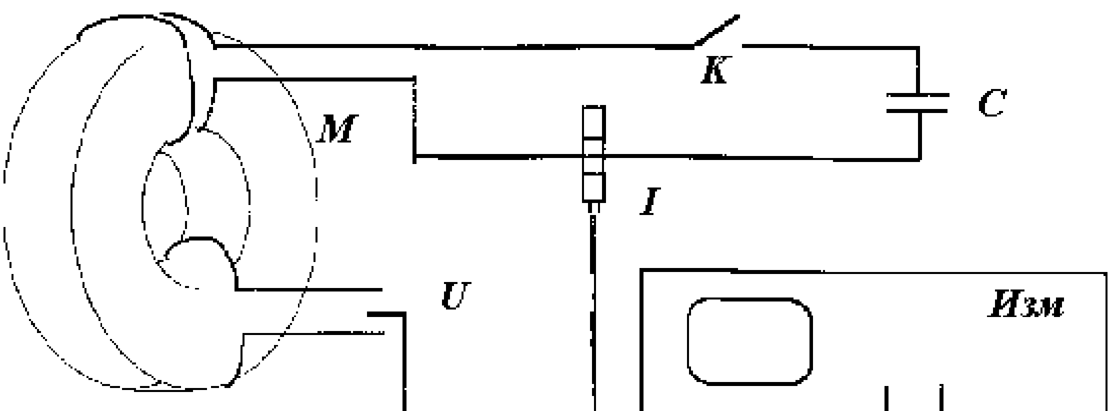


Fig.2

There were three sets of measurements performed:

1.- magnetization properties without any magnetic field;

2.- magnetization properties with main axis of the toroid directed along the solenoid axis;

3.- magnetization properties with main axis of the toroid directed at 45° to the solenoid axis.

Fig. 4 presents a trace of magnetization rate for the case 1. (voltage measurements using signal loop). Fig. 5 shows magnetization curve corresponding to 20 kV initial voltage level (U_C) (averaged for 5 cycles).

Fig. 6 and 7 provide us with the same information for the 2-nd case. **It is possible to conclude that in this field region fringe magnetic field directed along the core main axis does not change significantly pulse magnetization properties of the chosen material.**

Fig. 8 presents a trace of a magnetization rate for the case 3. The core was placed in a way that its plane was 45° to the axis of the solenoid. Figures 9 and 10 present magnetization curves for opposite polarities of magnetization current pulses (20 kV of the storage capacitor voltage). As it is possible to see, in this case fringe magnetic field changes magnetization pattern.

Fig. 3 shows dependence of core losses on magnetization rate for cases 1, 2, and 3 for the total flux density swing of 2.5 T. **Losses are significantly higher when there is a fringe magnetic field component parallel to the core plane.**

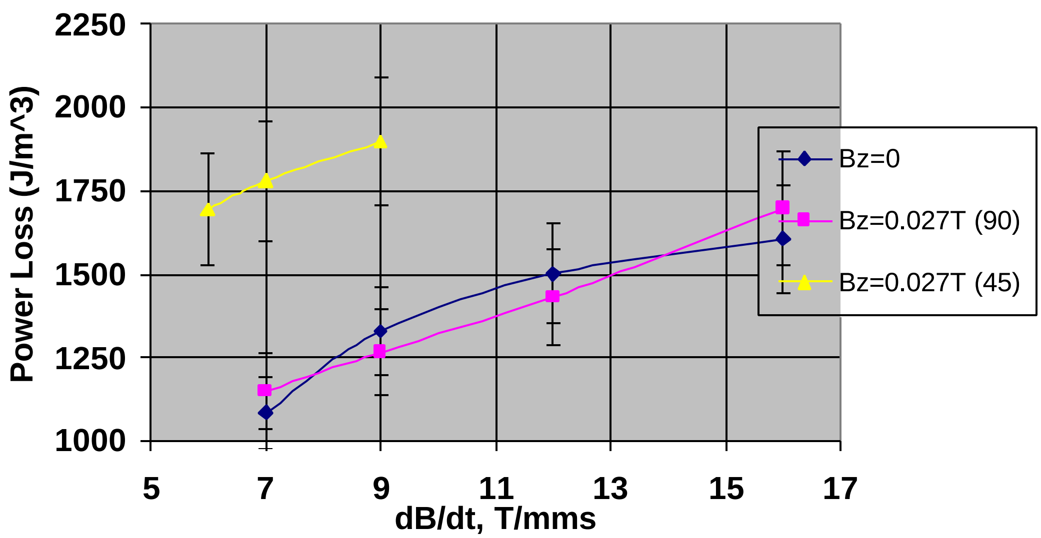


Fig. 3 Core power loss vs magnetization rate

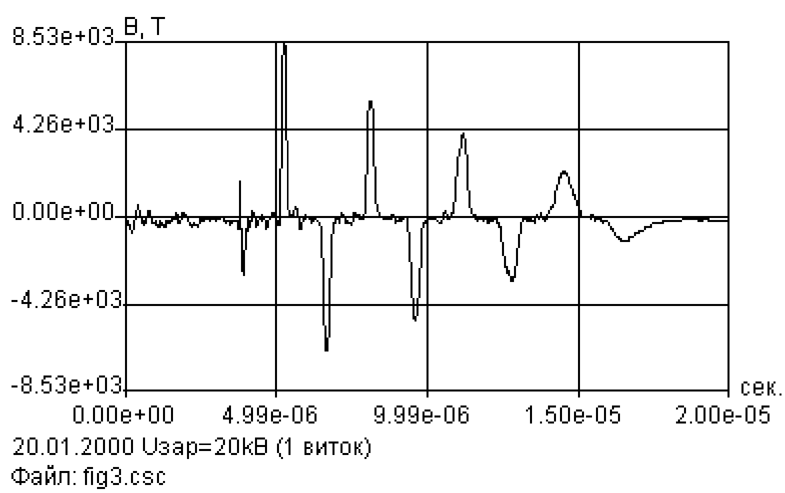


Fig. 4.

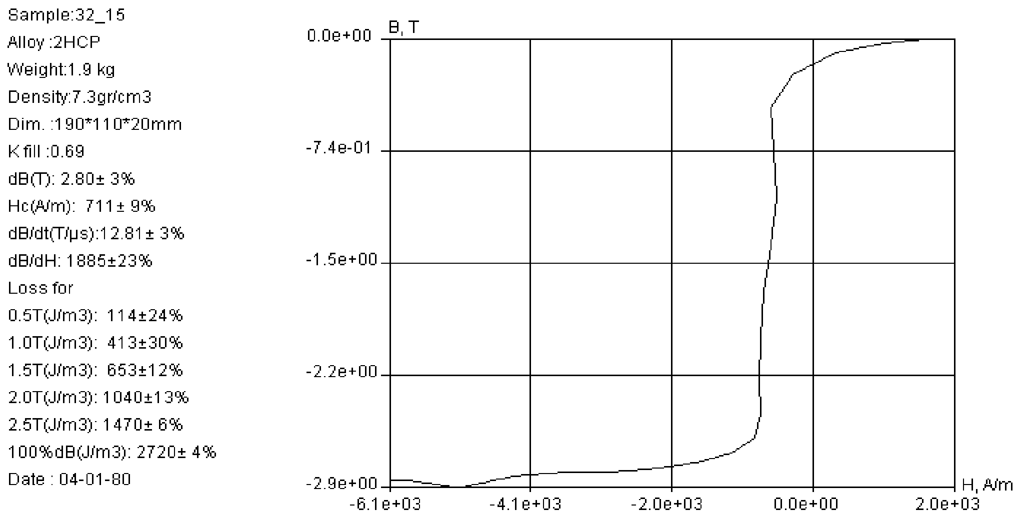


Fig. 5

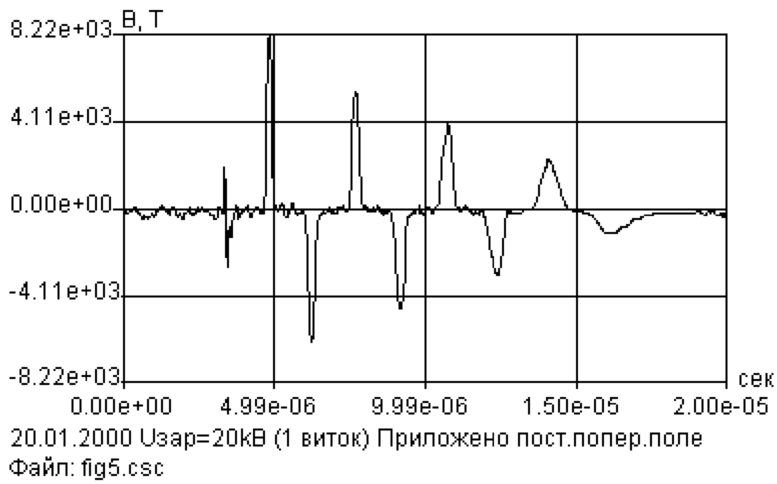


Fig. 6.

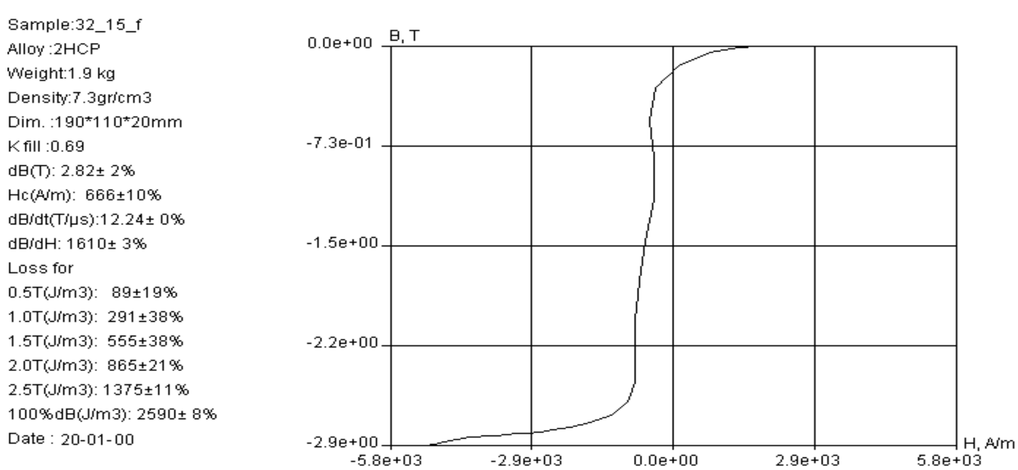


Fig. 7.

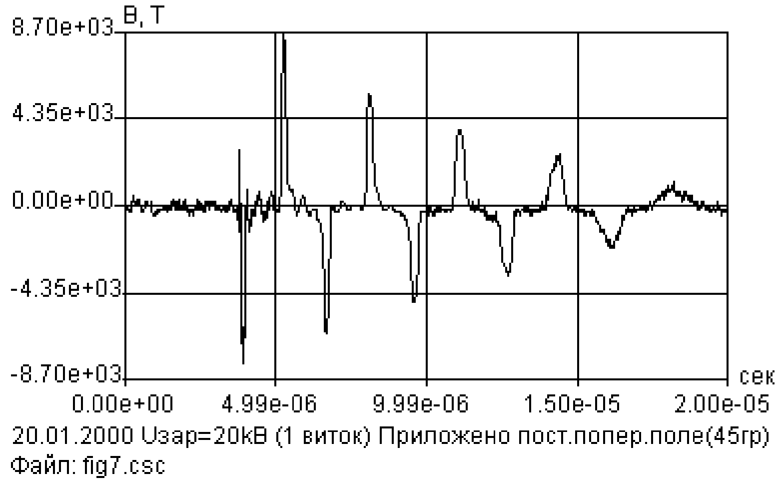


Fig. 8.

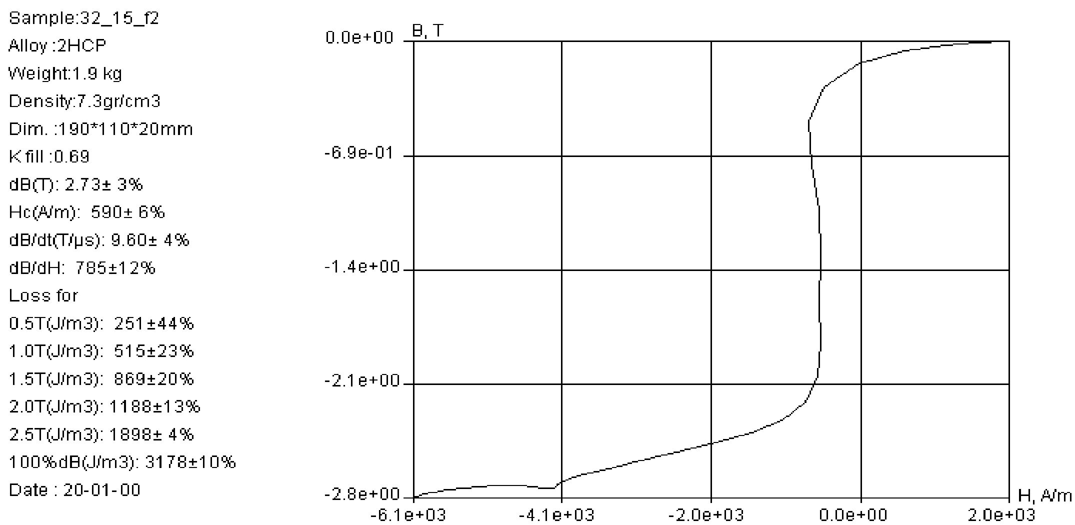


Fig. 9.

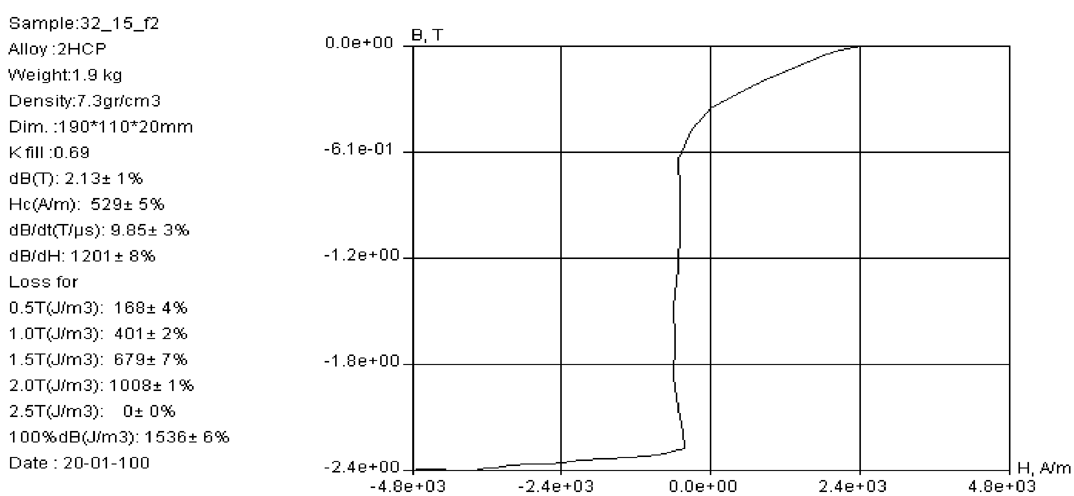


Fig. 10.