LOW-TEMPERATURE MAGNETIC HYSTERESIS OF MAGNETITE

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Hysteresis loops have been measured at various temperatures down to 5 K for two magnetite samples. Both samples are commercial magnetites with the mean grain size of few microns. One of them is fresh and relatively stoichiometric, SIRM (10 K) warming curves being characterized by relatively sharp Verwey transition centered at 115 K. Another sample is now 20 years old, and exposure to air during the elapsed time apparently resulted in a slight maghemitization. Verwey transition in this case is rather diffuse and transition temperature is estimated to be 95 K.

Hysteresis loops measured at very low temperature (10 K) display the most peculiar behavior. They were found to depend on whether the sample was previously cooled in zero or in non-zero magnetic field. Loops, measured after cooling in large (2.5 T) field, are much softer than those obtained after zero-field cooling. In addition, loops' shapes are essentially different for the two cases, as documented by the corresponding switching field distributions. However, these features largely disappear by 50 K.

Sample with oxidized magnetite, studied in more detailed way, exhibits yet another singular feature. Loops, measured after zero-field cooling, develop progressively larger asymmetry below 50 K, while no asymmetry was observed for the field-cooled loops.