Geophysical Research Abstracts, Vol. 8, 03102, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03102

Magnetic permeability and domain structure, and their influence on fluxgate magnetometer noise

B. Narod

Narod Geophysics Ltd, (bnarod@eos.ubc.ca)

We have performed three experiments designed to examine the relationships between particular magnetic material properties and fluxgate magnetometer noise.

The first experiment examines the relation in ring cores [toroids] between effective differential permeability and magnetometer noise. We find that there exists a strong inverse correlation. A classical derivation of differential permeability then leads to the conclusion that magnetometer noise reduces as does the number of active domain walls within the magnetic core.

The second experiment considers the relation between the ring core cross section and differential permeability and/or magnetometer noise. We find that, although the thin ribbons which are the norm for ring cores can have very high permeability when compared with circular cross-section materials, they do not necessarily offer superior noise performance. Wires of circular cross-section magnetic materials can offer good noise performance and offer several advantages during ring core fabrication and processing. The effects of shape with respect to magnetic heat treating will be discussed.

The third experiment separates the magnetometer noise effects of Barkhausen noise, and domain nucleation/denucleation, by suppressing Barkhausen noise. Our initial results imply that Barkhausen noise does not contribute significantly to fluxgate magnetometer noise. Domain nucleation/denucleation appears to be the primary source for magnetometer noise.

A fourth experiment, presently being developed, makes use of a magnetic heterojunction to suppress domain nucleation/denucleation energy transfer, while maintaining high differential permeability. Its goal is to examine in detail the relation between magnetometer noise and domain nucleation/denucleation.