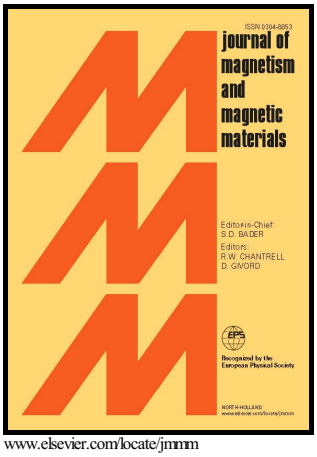

www.elsevier.com/locate/jmmm

A portable Hall magnetometer probe for characterization of magnetic iron oxide nanoparticles

Jefferson F.D.F. Araujo, Mateus C. Costa, Sonia R.W. Louro, Antonio C. Bruno

PII: S0304-8853(16)31533-5
DOI: http://dx.doi.org/10.1016/j.jmmm.2016.11.083
Reference: MAGMA62158

To appear in: *Journal of Magnetism and Magnetic Materials*

Received date: 22 July 2016
Revised date: 9 November 2016
Accepted date: 17 November 2016

Cite this article as: Jefferson F.D.F. Araujo, Mateus C. Costa, Sonia R.W. Louro and Antonio C. Bruno, A portable Hall magnetometer probe for characterizatior of magnetic iron oxide nanoparticles, *Journal of Magnetism and Magneti Materials,* http://dx.doi.org/10.1016/j.jmmm.2016.11.083

A portable Hall magnetometer probe for characterization of magnetic iron oxide nanoparticles

Jefferson F.D.F. Araujo, Mateus C. Costa, Sonia R. W. Louro and Antonio C. Bruno

Department of Physics, Pontificia Universidade Catolica do Rio de Janeiro, Rio de Janeiro 22451-900, Brazil

Abstract. We have built a portable Hall magnetometer probe, for measuring magnetic properties of iron oxide nanoparticles, that can be used for bulk materials and liquid samples as well. The magnetometer probe consists of four voltage-programmable commercial Hall sensors and a thin acrylic plate for positioning the sensors. In order to operate, it needs to be attached to a pole of an electromagnet and connected to an AD converter and a computer. It acquires a complete magnetization curve in a couple of minutes and has a magnetic moment sensitivity of 3.5×10^{-7} Am^2. We tested its performance with magnetic nanoparticles containing an iron oxide core and having coating layers with different sizes. The magnetization results obtained were compared with measurements performed on commercial stand-alone magnetometers, and exhibited errors of about ± 0.2 Am^2/kg (i.e 0.4%) at saturation and below 0.5 Am^2/kg (i.e. 10%) at remanence.

Keywords: Hall magnetometer; magnetic properties; iron oxide nanoparticles;

1. Introduction

Over the past decades, scientific research on various magnetic properties of bulk materials and fine particles has been assisted by using sophisticated characterization techniques. Properties such as the Curie temperature, saturation magnetization, remanent magnetization, coercive fields and magnetic anisotropy, are among the most important parameters of magnetic materials studied, ensuring their applicability. Several magnetometers, based on the superconducting quantum interference device (SQUID) [1],