Dr. Amitava Mitra, Chief Scientist of CSIR-National Metallurgical Laboratory, Jamshedpur, India was born in Sept 21, 1959 at West Bengal, India. He did his Ph.D from Indian Institute of Technology, Kharagpur in the year 1988 in the field of Magnetism and Magnetic Materials after completion of graduation and post graduation in Physics from University of Calcutta, India. After carrying his Post doctoral research at Institute of Applied Magnetism, Madrid with Spanish Govt. Fellowship, Dr. Mitra joined at CSIR- National Metallurgical Laboratory in the year 1990. Presently he is heading NDE & Magnetic Materials Group.

Dr. Mitra so far published more than 125 papers in SCI journals, filed 9 patents and developed three technologies in the field of Magnetism & Magnetic Materials. He is recipient of USAID fellowship and worked at Ames Laboratory & NDE Centre of Iowa State University, USA in the year 1994. He also worked at the Institute of Materials Research, Tohoku University, Japan in the year 2003 under JSPS invitation fellowship programme. He also visited Iwate University and National Institute of Materials of Japan in the year 2011 under short term JSPS invitation fellowship.

Dr. Mitra received various prestigious awards like National Metallurgist Day (NMD) Award: Best Metallurgist of the Year-2006 in Metal Science area awarded by Ministry of Steel, Govt. of India; Wolfson Distinguished Lecturer: 2005 by Wolfson Centre for Magnetics, University of Cardiff, U.K; National NDT award for system innovation and Development in year 2000; National NDT award for R&D in 1997 by Indian Society for Nondestructive Testing; MRSI Medal-2011 by Materials Research Society of India etc.

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Characterisation of Semi-finished Steel Products using Electromagnetic NDE Techniques

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Products from steel plants are rolled and heat-treated to achieve requisite composition and microstructure for desired mechanical properties. Further processing is required to make these plant products into value added finished product. Presence of any defect or undesirable phases affects the quality of the finished product and thereby rejected by the manufacturer which leads to financial loss to the industries and this loss is many fold if the product is from high end steel like dual phase or triple phase steel. The present talk will deal in the characterisation of semi finished product from the steel industries using electromagnetic NDE techniques particularly magnetic hysteresis and magnetic Barkhausen emissions using a device ‘MagStar’ developed at CSIR-National Metallurgical Laboratory in association with Technofour, Pune, India

The microstructure of duplex stainless steel consists of a mixture of austenite and ferrite phases wherein their relative percentage determines the mechanical properties of the product. As the ferrite phase is magnetic, it is expected that the magnetic property will change with the relative volume fraction of the phases. A good correlation with the saturation magnetisation and the ferrite volume fraction determined through the image analysis has been observed in 2205 duplex steel indicating the technique to be a potential tool for evaluation of volume fraction of ferrite and austenite phases vis-a-vis the mechanical property of the steel. Similarly, the effect of heat-treatment in modified 9Cr-1Mo steel has been studied using magnetic Barkhausen technique which can assure the microstructure of the product for further processing as high temperature component. The work has been extended to the assessment of plain carbon steel wire where carbon composition is very important for further processing to welding rods. The presently used NDE technique is suitable for the surface characterisation. However, magnetic hysteresis loop can determine the bulk property. The present study indicated that a small variation in carbon percentage also reflected in the saturation magnetization and Coercivity value of the wire rods.

Key words: Magnetic hysteresis loop, Magnetic Barkhausen emissions, semi-finished product