Characterization of peening-induced residual stresses on mumetal material using needle probes technique.

Yves Armand Tene Deffo¹, Bhaawan Gupta^{2,3}, Benjamin Ducharne², Pierre Tsafack¹, Laurent Morel⁴

¹Faculty of Engineering, Buea University, Cameroon E-mail: <u>ytenedeffo@yahoo.com</u>

²Laboratoire de Génie Electrique et Ferroélectricité, France E-mail: <u>benjamin.ducharne@insa-lyon.fr</u>

³ELyTMaX Tohoku University, Japan E-mail: <u>bhaawan.gupta@insa-lyon.fr</u>

⁴Laboratoire Ampère, Université Claude Bernard Lyon 1, France E-mail: <u>Laurent.Morel@univ-lyon1.fr</u>

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The use of micro-magnetic nondestructive controls has increased exponentially in the industrial field [1]-[2]. Current advancement in non-destructive testing and evaluation (NDT&E) allows the stress status estimation of ferromagnetic structures by magnetic measurement methods [3]-[4]. The needle probe, neglecting the air flux voltage, forms an equivalence in measurement of a half-turn search coil under symmetry of flux distribution in the material [5]-[6]. This technique involves measuring the surface flux density in an area in between a pair of needle tips based on the potential difference produced by eddy currents generated by ac magnetization. This paper aims at measuring micro-residual stresses due to inelastic strain distribution on a peened plate of 50% FeNi alloy described in [7]. The results show the residual stress dependency of the materials' magnetic properties (Fig. 1-a). This is due to stress contribution to the effective field induced by the peen shot impact confined within a bounded domain of the material in the same order as in [7]. However, an observable difference was the widening of the stress induced region accounting for the evolution of residual stress during life in-service giving rise to new residual stress spots as observed in Fig. 1-b.



Fig. 1 Magnetic properties of the material along the reference line (a) coercive field (b) Hysteresis cycle

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