Evaluation of hardened and non-hardened regions using eddy current testing

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Abstract
A steel plate having hardened and non-hardened regions in one plate is promising material in automobile field owing to its high performance. This steel plate has to be evaluated whether the non-hardened region was prepared properly at the desired position with desired hardness. However, the conventional evaluation method of hardness measurement is destructive testing and requires a long inspection time. Therefore, a reliable and fast nondestructive inspection method is required. In this study, the hardened and non-hardened regions were evaluated using an eddy current testing (ECT) to distinguish each region. The measured resistivity and permeability at each region were different and these differences were found to be caused by the crystal structure change of heat treatment. Therefore, the magnetic response between the hardened and non-hardened regions was different and this difference was correlated with the hardness of each region. These results indicate that the hardened and non-hardened regions can be distinguished using ECT.
Eddy current testing is an important electromagnetic non-destructive evaluation technique that is widely used in power, aerospace, petrochemical and other industries for detection of surface cracks and sub-surface damage in components made of metallic materials. Besides, it is also used traditionally for assessing the adequacy of heat treatment of alloys, as eddy currents are sensitive to changes in microstructure and stresses, which alter the electrical conductivity and magnetic permeability of the material. In this study the amount of the pearlite content is analyzed using the eddy current testing response. Abbasi et al [10] studied the various precipitated hardened parts of Al-7075 are analyzed by coil probe at 6 KHz of eddy current response.