1.2.17. USING NONDESTRUCTIVE EDDY CURRENT TECHNIQUE AS A TOOL FOR QUALITY CONTROL OF CARBURIZED STEELS

Kashefi T.M., Sheikh A.M., Ferdowsi University of Mashhad, Mashhad, Iran

Surface carburization of low carbon steels parts, especially those are used in automotive industry, is a common process for improvement of surface mechanical properties. In this process, it is necessary to control the surface carbon content in order to obtain desirable materials properties. Although quantometry is the most common method for determination of surface carbon content, being destructive, costly and time consuming are some disadvantages of this method. Furthermore, applying this method is not possible for all samples in mass production. Eddy current testing has long been used as a technique for investigation of defects. However, recently, characterization of properties of materials has been a focus of intense investigation. Research have been published which show the strong ability of eddy current technique in determination of microstructure, hardness, strength of steels as well as cast irons and non-ferrous alloys.

Determination of surface carbon content in carburized steels is a new application for eddy current method which has been studied in this research. Sixteen AISI 4118 steel samples have been carburized in an enriched carbon gas carburizing furnace. Carbon potentials in the furnace were different for each sample; therefore, samples with various surface carbon contents were produced. To insure uniform microstructure, before eddy current testing, all the samples were normalized using an induction heating furnace. Subsequently, the carbon content of all samples was measured using quantometry. Finally, determining the optimal frequency, eddy current testing was applied for all samples and the relationship between surface carbon content and various parameters such as normalized impedance and phase angle has been established and correlation coefficient (R^2) has been calculated. The study shows a good relationship between the carbon percent and phase angle can be established ($R^2 = 0.91$) using phase angle. Besides, the effect of temperature on the relationship was also investigated using three levels in 0,30 and 80°C. The formulas presented, shows improvement in corresponding corrections in experimental data.