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Characterization of material properties of 2xxx series Al-alloys by non destructive testing techniques

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2xxx series Al-alloys are widely employed in structural applications due to their good mechanical properties. During heat treatment of these alloys, solution treated parts sometimes mixed with age hardened parts during handling. This result in difficulty in distinguishing between solution treated and aged parts of various grades. Moreover, it is also necessary to separate improper aged parts from properly treated parts. The traditional methods of characterization of different heat treated parts are hardness, tension testing and microscopy, however these are destructive in nature and sometimes not desired particularly for finished products. The main purpose of this paper is characterization of material properties of 2xxx series Al-alloys by eddy current and ultrasonic NDE techniques so that the inspection can be carried out effectively in the shortest possible time. Three wrought Al-alloys of 2xxx series (AA 2014, AA 2024 and AA 2219) were homogenized followed by solution heat treatment and age hardening treatments at specific temperatures for 1–16 h. The changes in hardness and microstructure during heat treatments were determined by traditional material characterization methods and then correlated with electrical conductivity, sound velocity and attenuation coefficient obtained through Nondestructive Evaluation (NDE) techniques. Results demonstrated an excellent correlation between hardness and sound velocity, whereas extend of aging can be easily predicted by electrical conductivity, and attenuation coefficient measurement. Investigation suggested a way towards the non-destructive detection and characterization of material properties when conventional testing methods are not applicable.

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