

EFFECT OF CYCLIC HEAT TREATMENT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF C45 STEEL

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ABSTRACT

Cyclic heat treatment consisting of repeated short duration (6 minutes) holding above the A_{c3} temperature (850 °C) followed by forced air cooling was performed to C45 steel. Reflected light microscope (RLM), scanning electron microscope (SEM), hardness measurement, and tensile testing were used to investigate the effect of this technique of heat treatment on both microstructure and mechanical properties of this type of steel. The obtained results indicated that refinement of the microstructure and consequently modification on mechanical properties was achieved. The grain size of both proeutectoid ferrite and pearlite was decreased and the completely lamellar pearlite started in disappearance after the first cycle. By increasing number of cycles the amount of lamellar pearlite decreased and on the other hand the amount of cementite spheroids in the pearlite grains increased. Also, the inter-lamellar spacing of lamellar pearlite decreased from 0.75 to 0.28 μm by this type of heat treatment after 10 cycles. As a result of these microstructure modifications, both hardness and ultimate tensile strength improved and in the same time the high ductility was retained.

KEYWORDS: C45 Steel, Cyclic Heat Treatment, Annealing, Ferrite, Lamellar Pearlite, Cementite Spheroids