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Evaluation of Mechanical Properties and Analysis of Rapidly Heat Treated M-42 High Speed Steel

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Abstract : M42 is a molybdenum-series high-speed alloy steel widely used because of its better hot-hardness and wear resistance. These steels are conventionally heat treated in a salt bath furnace with up to three stages of preheating with predetermined soaking and holding periods. Such methods often involve long periods of processing with a large amount of energy consumed. In this study, the M42 steel samples were heat-treated by rapidly heating the specimens to the austenising temperature of 1260 °C and cooled conventionally by quenching in a neutral salt bath at a temperature of 550 °C with the aid of a hybrid microwave furnace. As metals reflect microwaves, they cannot directly be heated up when placed in a microwave furnace. The technology used herein requires the specimens to be placed in a crucible lined with SiC which is a good absorber of microwaves and the SiC lining heats the metal through radiation which facilitates the volumetric heating of the metal. A sample of similar dimensions was heat treated conventionally and cooled in the same manner. Conventional tempering process was then carried out on both these samples and analysed for various parameters such as micro-hardness, processing time, etc. Microstructure analysis and scanning electron microscopy was also carried out. The objective of the study being that similar or better properties, with substantial time and energy saving and cost cutting are achievable by rapid heat treatment through hybrid microwave furnaces. It is observed that the heat treatment is done with substantial time and energy savings, and also with minute improvement in mechanical properties of the tool steel heat treated.

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