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Optimization of Heat Treatment Parameters for the Tensile Properties of Medium Carbon Steel

Abstract- *The purpose of this study is designate quenching and tempering heat treatment by using Taguchi technique to determination optimal factors of heat treatment (tempering temperature, percentage of nanoparticles, type of base media, nanoparticles type and tempering time)for increasing ultimate tensile strength, yield strength and ductility properties of medium carbon steel. An (L18) orthogonal array was chosen for the design of experiment. The optimum process parameters were determined by using signal-to-noise ratio (larger is better) criterion. The importance levels of process parameters on tensile properties were obtained by using analysis of variance, which applied with the help of (Minitab18) software. Percentage of volumetric fractions of nanoparticles with three different levels(0.01, 0.03 and 0.08 %) were prepared by dispersing nanoparticles that are (α-Al2O3,TiO2 and CuO) with base fluids (De-ionized water, salt solution and engine oil).Medium carbon steel specimens were suffered to hardening and tempering heat treatment process. The variables of tempering heat treatment were temperatures (400 C˚, 550 C˚) and a soaking times (30, 45 and 60 minutes) respectively. Tensile testing performed on samples using united universal hydraulic machine. The results for (S/N) ratios showed the order of the factors in terms of the proportion of their effect on ultimate tensile strength, yield strength and ductility properties as follow: Tempering temperature (400 C˚) ,Nanoparticles type (TiO2),Tempering time (30 min),Type of base media (salt solution, engine oil) and Percentage of nanoparticles (0.03%) was the least influence for ultimate strength and yield strength while for the elongation were as follows: Tempering temperature (550 C˚),Tempering time(60min), Nanoparticles type (CuO),Type of base media (deionized water) and last percentage of nanoparticles (0.08%).*

Keywords-*Nanofluids, quenching, tempering, tensile properties, Taguchi technique.*

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