1. Effect of Retained Austenite on theMechanical Properties of AISI 4340 Steelusing Magnetic Saturation Measurement and XRD methods

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ABSTRACT

The mechanical properties and microstructure of low-alloy steel aresignificantly affected by the amount of Retained Austenite. Therefore, in thispaper, Retained Austenite volume fractions have been evaluated in AISI4340 alloy steel experimentally using two well-known methods, XRD and magnetic measurement methods. After heat treatment processes were carried out by heating to different temperatures then cooling in different media followed by tempering process, a comparison between XRD method and magnetic measurement method results proved that there results were approximately identical .The results shows that the amount of Retained Austenite increase as heating (Austenizing) temperature increase for the same cooling media, as well as, it increases by increasing cooling rate. The maximum amount of Retained Austenite found as (27.2 Wt %) which recognized when the specimens heated up to (1000˚C) then quenched in Water while the minimum amount of Retained Austenite found as (7.06 wt%) when the specimens heated up to (800 ˚C) then cooled in Sand. Hardness tests using Rockwell and Vickers methods were used and the results show that hardness values decreased with increasing heating temperatures and Retained Austenite fraction, the maximum Rockwell and Vickers hardness numbers were equal to (121.8HRB) and (516.35 HV) which were detected when heating up of the specimens were up to (800 ˚C)then quenched in water. Tensile tests results show that increasing cooling rate lead to increasing in strength due to increasing of hardness which in turn, leads to increase in yielding points and ultimate strengths. As well as, the increasing in volume fraction of Retained Austenite produced an increasing tensilestrength until reached to proximately 14% after that, tensile strength decreased with increasing Retained Austenite. Retained Austenite effects on microstructure were investigated using SEM and optical microscopy and the results showthat at a low cooling rate, the microstructure consist of Bainite and/or Martensite phase with small amount of Retained Austenite, while, increasing cooling rate and heating temperature result in microstructure consist of Martinsite and Retained Austenite phases.The results of this thesis were compared with other researcher's results, there are show a very good compatibility between both results.