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Modelling of precipitation hardening behavior of 17-4PH steel and the influence of previous deformation

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UNS S17400 (AISI 17-4PH) is a precipitation hardening steel with several applications in energy generation, oil and gas, aerospace and chemical industries. The hardening effect is mainly produced by the precipitation of copper rich phases (CRP). In this work, the precipitation hardening and overaging behavior of a thermomechanically processed 17-4 PH steel was investigated and modelled. One set of samples were solution treated at 1050oC and quenched before aging at 400°C, 440°C, 480°C, 495°C and 550°C for different periods of time. Another set of specimens was solution treated and cold rolled with 40% of reduction before aging at the same conditions of the un-deformed samples. This way the effect of previous cold rolling on the kinetics of precipitation was evaluated. The Vickers hardness (HV10) of all specimens were measured to obtain the precipitation hardening curves (HV10 versus aging time). Aging curves were modeled by modified Avrami equation (?H=Kt^n), and samples with and without previous work hardening were compared to obtain the change in activation energy for precipitation. Overaging produced at higher aging time and temperature was also investigated, taking in account the formation of reverse austenite and precipitate coarsening.