Evolution of Residual Stress on AISI D2 tool steel short time tempering

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Some parameters are used in an attempt to estimate a relationship between time and tempering heat treatment temperature of steels, among which the Hollomon-Jaffe parameter stands out [1]. This work aimed to study the evolution of residual stresses in short-time tempering treatment of AISI D2 tool steel, compared to conventional heat treatment of tempering [2]. The samples were treated in dilatometry for a better control of the thermal processing variables. Microstructural images were generated using optical and scanning electron microscopy, including mapping using EDS. Vickers microhardness measurements were performed. And the measurements of variations in residual stresses in each of the treatment stages and at the end of the treatment cycles were performed by analyzing the X-ray diffraction data using the Sen2Ψ technique [3]. The cycles composed of tempering in short times carried out at 500 ºC or 600 ºC, for 10 seconds or 1 minute, exhibited residual stress states similar to the conventional cycle, with a tendency towards neutrality of the residual stress state and high hardness values. The final residual stresses acquired by the AISI D2 tool steel in the thermal cycles studied, more specifically in the tempering, can be attributed to the precipitation of tempering carbides, which when carried out up to 600 ºC, occurs coherently, or at least partially coherently, to the matrix, producing the neutrality of residual stresses, but when tempering is carried out at 700 ºC, it leads to incoherent precipitation of carbides and matrix recrystallization, leading to an increase in compressive residual stresses and a reduction in the hardness of the material, regardless of the heat treatment time of tempering.

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References:

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