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A Viscoplastic model with thermally activated hardening recovery for metallic alloys: application to stainless steel welding

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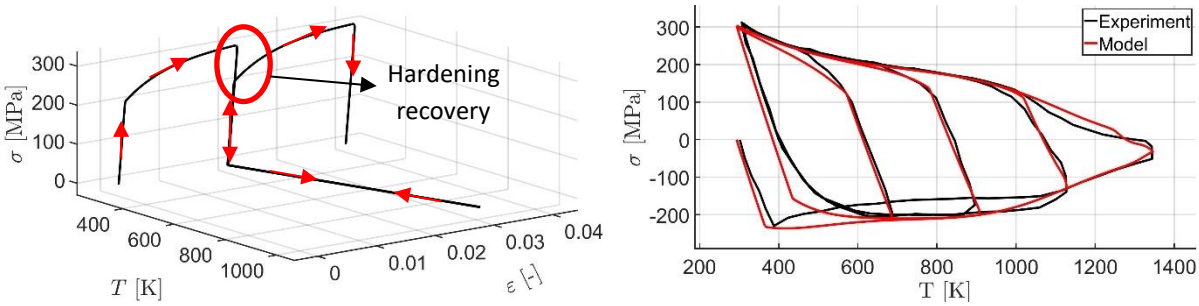
The hardening recovery is a thermally activated phenomenon that enables metallic alloys to restore their mechanical properties upon high temperature exposures. Such a process is induced by microstructural changes like dislocations annihilation or recrystallization.

In this work, a new constitutive model is proposed to describe this hardening recovery mechanism [1] in a temperature- and time-dependent plasticity formulation with kinematic hardening [2]. The model is identified for 316L stainless steel through a stepwise experimental procedure (Fig.1). Further simulations are provided to demonstrate the predictive capabilities of the model upon thermomechanical loading paths that are representative of the welding process [3] [4].

Keywords: Constitutive model, viscoplasticity, kinematic hardening, hardening recovery, thermomechanical behavior



a) b)

Fig.1: a) Hardening recovery simulation b) Satoh experiments [3] (black line) vs numerical simulation integrating hardening recovery (red line)

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