# Thermomechanical Analysis of an Electrically Assisted Wire Drawing Process

Sánchez Egea, A. J., González Rojas, H. A., Celentano, D. J., Jorba Perió, J., & Cao, J. (2017). Thermomechanical analysis of an electrically assisted wire drawing process. Journal of Manufacturing Science and Engineering, 139(11). <10.1115/1.4037798> Accessed 26 Apr 2021.

**Abstract**

Electrically assisted (EA) wire drawing process is a hybrid manufacturing process characterized by enhancement of the formability, ductility, and elongation of the wire drawn specimen. A thermomechanical model to describe the change of the mechanical response due to the thermal contribution is proposed in this work. Additionally, a numerical simulation was conducted to study the potential and limitations of this hybrid process by using two different hardening laws: a phenomenological and a dislocation-based hardening laws. The results show how the flow stress, the effective plastic strain, and residual stresses behave under the electroplusing effect. In addition, electron backscattered diffraction was used to study the electropulsing treatments on the microstructure during cold drawing. It is observed a decrease of the high- and low-angle grain boundaries (LAGB) for samples deformed with electropulsing. This detwinning process has a strong influence on the strain hardening by improving the material formability. It was shown that the two proposed hardening laws adequately describe the EA wire drawing process showing a similar mechanical behavior. Nevertheless, the dislocation-based hardening law has the potential to be generalized to many other material and process configurations without extensive number of material tests as the phenomenological hardening law would require..

**Keywords**

electroplusing, wire drawing, themomechanical modeling, simulation, Detwinning process.