Mechanical and metallurgical changes on 308L wires drawn by electropulses

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Abstract

The electroplastic effects resulting from different electropulses configurations on a wire drawing process are investigated experimentally and numerically. Electropulses are induced into 308L stainless steel while it is simultaneously wire drawn. A current density of 185 A/mm2, a frequency range from 140 to 355 Hz and a pulse duration range from 100 to 250 μs are combined to electrically assist the wire drawing process. The electropulsing influence is studied in several mechanical parameters, like drawing forces, stress–strain curves and the effective energy required for each electric configuration. X-ray diffraction and electron backscatter diffraction techniques are used to determine the impact of electropulses on the microstructure, in order to explain the mechanical behaviour variations. The results show that the formability of the material increases up to 11.9%, while the relative energy efficiency of the process improves up to 7.6% when the specimens are assisted in situ by electropulses. Moreover, the microstructure and phase determination analysis denoted that the electropulses induce a dynamic recrystallization process, a detwinning process and also an attenuation of α martensite..

Keywords

Electropulse, Drawing forces, Electroplasticity, Simulation, Microstructure, Phase transformation.