Influence of Low-Amplitude High-Frequecy Pulsed Current on the Deformation Characteristics of Low and Medium Carbon Steels

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When electrical pulses are applied to a metal during deformation, the resistance to deformation is dramatically reduced while the plasticity increases significantly. This phenomenon is introduced as electroplasticity. Macroscopic observations of yield stress reduction under current pulsation due to uniaxial tension, creep and stress relaxation is in the center of attention recently.

Traditional manufacturing processes such as drawing, and rolling be contingent on the use of heat to reduce the forces associated with the fabricated parts. The high-temperature requirement is potentially leading to stress, warpage, and reduced tolerance control. Therefore, Electrically Assisted Manufacturing is introduced as an effective way of simplifying the fabrication while enhancing end- product properties.

The electroplastic deformation of low and medium carbon steels under uniaxial tensile conditions were investigated with respect to the universal uniaxial tensile testing conditions. A significant reduction of yield stress of low and medium carbon steel with different carbon content were observed due to electroplasticity effect. A qualitative and quantitative analysis of yield stress reduction was carried out. Microstructural behavior and morphological aspects of fractured and strained surfaces of low and medium carbon steel specimens were observed.

Keywords: Electro plasticity, Electron wind force, Dislocations, Uniaxial tensile test, Electrically assisted manufacturing, Low and medium carbon steel, Plasticity