

Effects of Retained Austenite Transformation on the Tensile Deformation Response of 300M Steel

M. J. Leap
Sandia National Laboratories
Albuquerque, New Mexico 87185

Abstract

Transformation-induced plasticity (TRIP) of interlath retained austenite is investigated for a 300M steel with a $\sim 2,100$ MPa tensile strength. Stress-induced transformation during elastic loading at -196°C reduces but does not eliminate retained austenite from the microstructure. This transformation generates a transient reduction in plastic strain hardening rate, $d\sigma/d\varepsilon_p$, immediately after yielding, but this effect has no significant impact on subsequent tensile deformation at -196°C or room temperature. Strain hardening in combination with high strain energy density promote strain-induced transformation before the ultimate tensile strength during tensile testing at -196°C , and this manifestation of the TRIP effect is associated with an increase in the extent of uniform elongation relative to tensile deformation at room temperature. In contrast, strain-induced transformation is limited to plastic strains in the vicinity and beyond the tensile strength during room-temperature deformation.

Keywords: High-strength steel, stress-induced martensite transformation, strain-induced transformation, tensile deformation, strain hardening

This paper describes objective technical results and analysis. Any subjective views or opinions that might be expressed in the paper do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

Sandia National Laboratories is a multission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy, National Nuclear Security Administration under contract DE-NA0003525.