9807 Reducing the Variability of HSLA Steels

Benefits

Reducing the Variability of the yield strength of HSLA steels will:

- Allow the use of HSLA steels with higher yield strength levels.
- Reduce the amount of springback and thereby reduce the cost of die-design and start-up for stamped parts.
- Reduce the rejection rates in the steel plant.
- Reduce the rejection rates in the stamping plant.
- The use of HSLA steels in automobiles will increase fuel efficiency.

Applications

Primarily automobile body parts.

Increased knowledge of the high-speed deformation behavior of multiphase sheet steels will result in lighter, safer, more energy-efficient automobiles

The development of optimized multiphase steels with improved strength/formability combinations and high strain rate properties offers the potential for significant weight reduction. In addition, accurate characterization of properties at elevated strain rates will provide improved data on material constitutive relationships that will be used as input for improved formability crash modeling simulations.

This project addresses three basic hurdles: (1) Establishing the capability of testing sheet steel properties under elevated strain rate conditions; (2) Understanding the microstructure and property interrelationships at high strain rates and; (3) Developing suitable chemistry and processing approaches.

This work will quantify the effectiveness of different metallurgical strengthening mechanisms at elevated strain rates.

Furthermore, the global state-of-the-art in multiphase sheet metallurgy and vehicle application will be assessed, and a testing capability will be established for evaluation of high strain rate properties.

Project Description

One source of the variability in the strength of HSLA steel is the fluctuation of processing in the hot strip mill. This source of product variability has not been completely investigated. Working with a 70 ksi HSLA steel, the variations in the evolution of microstructure during laboratory hot rolling can be monitored as different levels of reheating, roughing, finishing and coiling temperatures are used. Measurement of the mechanical properties of the hot band and the subsequently cold-rolled and annealed strip will allow identification of the processing steps responsible for the major portion of the property variability. The next step is to relate this variability to the observed changes in microstructure during processing. From prior knowledge of the interdependence of microstructure, processing variables, and chemistry, recommended ways to adjust the steel chemistry will emerge.

The goal of this project is to identify the relative influence of different hot mill processing steps on the yield strength variability of an HSLA steel and to recommend changes in chemistry that will reduce such variability.

Progress and Milestones

- Obtain commercial slab material and complete characterization of as-cast microstructure.
- Complete hot rolling experiments and characterization of hot band material.
- Complete evaluation of the mechanical properties of hot rolled material.
- Complete cold rolling and annealing.
- Complete evaluation of mechanical properties of cold rolled and annealed material.
- Complete microstructural characterization.
- Submit final report and recommendations.

Total Project Cost/Duration

$548,000/four years.

Research Organization

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