0038 Characterization Of Fatigue And High Strain Rate Deformation Performance Of A New Generation High-Strength Steels

Benefits

- Application of a new generation of high-strength steels with a 25 percent greater strength-to-weight ratio
- Estimated energy savings of 6.8 X 10^{12} British thermal units (Btu) per year based on a reduction of 4,000,000 tons per year of steel production
- Reduction of CO_2, NO_X (as NO_2), SO_X (as SO_2), and particulate emissions
- Energy savings in the transportation industry due to reduction of automobile weight when using the new generation of high-strength steels

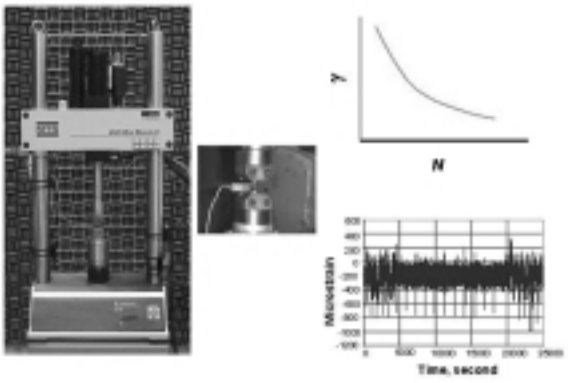
Applications

High strength steels, such as dual phase and TRIP, will find extensive use in the appliance, office furniture, transportation, construction machinery, and modular construction markets.

Research Data Will Ensure Successful Application Of New Generation High-Strength Steels That Have A 25 Percent Greater Strength-To-Weight Ratio

In accordance with the Steel Industry Technology Roadmap, the American Iron and Steel Institute (AISI), in conjunction with the U.S. Department of Energy (DOE), and Ispat Inland Research Laboratories are conducting a two-year project that entails characterizing the fatigue and high strain rate deformation behavior of new dual phase and transformation-induced plasticity (TRIP) high-strength steels that are currently being developed by the North American steel industry.

To successfully apply new generation high-strength steels, including dual phase and TRIP steels, it will be necessary to provide the industry with quality data on fatigue and high strain rate deformation performance. This project will generate data to resolve these issues by conducting fatigue and high strain rate deformation behavior tests. These data are critical for advanced high-strength steels to compete with current steel and other materials in a variety of flat roll steel markets: appliance, office furniture, transportation, construction machinery, and modular construction. With appropriate property data, technical barriers to the use of these new steel grades are solvable by existing engineering methodologies.



Project Description
Goal: To successfully apply new generation high-strength steels, including dual phase and TRIP steels.

This project is divided into two phases. The first phase will generate fatigue-testing data for these steels produced by North American member steel companies. The data can be direct inputs for durability analysis. The second phase will generate tensile and component test data at high strain rates. These data can be used as direct inputs for engineering and design analysis or for verification of FEA simulations by customers and/or steel companies.

The overall energy savings and reductions in related environmental impacts are projected to be approximately 1.2 percent of the current production requirements for the American steel industry. However the true benefit of these steels is that they will reduce the production requirements of current high-strength steels by 25 percent.

Progress and Milestones
Specifically, the program will include the following tasks:

- Project start date, January 2001.
- Conduct fatigue tests: smooth specimen strain controlled fatigue test and stress controlled tests for notched specimens to establish fatigue notch sensitivity.
- Conduct tests on high strain rate deformation behavior and provide data for steel companies to validate their FEA simulation methods and to better understand the use of intrinsic steel properties in estimating high strain rate deformation performance.
- Project completion date, January 2003.

Total Project Cost/Duration
$541,000/2 years

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