Technique for Single Sensor Differential Thermal Analysis

Summary

Researchers at The Ohio State University have developed a technique for single sensor differential thermal analysis (SS-DTA) that determines the solid-liquid and solid-state phase transformations during the actual processing of metals and alloys. The SS-DTA technique is based on single sensor temperature measurement and computerized acquisition of the thermal history in particular locations of the processed metal. The heat of reaction and temperatures of the phase transformation are measured by software that processes the thermal data. This new technique was verified by direct comparison to the classic differential thermal analysis (DTA) as well as dilatometry. It has been successfully applied for in-situ determining the solidification ranges and solid-state phase transformation temperatures in welded joints of various alloy steels, non-ferrous alloys and Ni-base superalloys, and for development of continuous cooling transformation diagrams. In addition, phase transformation behavior during weldability testing, post-weld heat treatment, and casting has also been measured. It has been successfully applied with a thermo-mechanical simulator. The SS-DTA technique is performed utilizing a device for the investigation of phase transformations (DIPT) that was also developed by The Ohio State University.

Main Advantages of Technical Approach

- Applicable at non-equilibrium heating and cooling rates and in actual processing conditions.
- Applicable and highly sensitive to the entire range of solid-liquid and solid-state phase transformations in metal and alloys and to the magnetic transformation (in ferrous alloys).
- Fast, simple and cost-effective; Applicable as a more sensitive and accurate alternative or back up to dilatometry in simulation equipment.
- Potential for measuring precipitation and recrystallization reactions and for quantifying the volume fraction of formed phases.

Market Potential

- Development of new alloys and welding consumables.
- Investigation of microstructure evolution under actual processing conditions of thermal and thermo-mechanical processing.
- Study of microstructure-property relationships and material fabricability.
- Development and testing of procedures for thermal and thermo-mechanical processing of metals and alloys.

Inventor (s)

Boian Alexandrov
John Lippold

Intellectual Property Status

US Patent Pending

Contact Information

Ryan Zinn
zinn.7@osu.edu | 614-292-4540
Technology Licensing & Commercialization
The Ohio State University
1216 Kinnear Road
Columbus, OH 43212-1154

Reference

05076

Printed on: 02/10/2010