Real-time monitoring and prediction of martensite formation and hardening depth during laser heat treatment

Mohammad H. Farshidianfar, Amir Khajepouhor, Adrian Gerlich

PII: S0257-8972(17)30209-8
DOI: doi: 10.1016/j.surfcoat.2017.02.055
Reference: SCT 22151

To appear in: *Surface & Coatings Technology*

Received date: 3 November 2016
Revised date: 29 January 2017
Accepted date: 19 February 2017

Please cite this article as: Mohammad H. Farshidianfar, Amir Khajepouhor, Adrian Gerlich , Real-time monitoring and prediction of martensite formation and hardening depth during laser heat treatment. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), doi: 10.1016/j.surfcoat.2017.02.055

Real-time Monitoring and Prediction of Martensite Formation and Hardening Depth during Laser Heat Treatment

Mohammad H. Farshidianfar[1*], Amir Khajepouhor[2], Adrian Gerlich[2]

[1]PhD Candidate, Mechanical and Mechatronics Engineering Department, University of Waterloo, ON, Canada, N2L3G1, Email: mhfarshi@uwaterloo.ca, Tel: +1-226-750-8326, Fax: +1 519-885-5862

[2]Professor, Mechanical and Mechatronics Engineering Department, University of Waterloo, ON, Canada, N2L3G1

Abstract

An automated real-time thermal monitoring system is developed to monitor the thermal dynamics of the Laser Heat Treatment (LHT) process online. The infrared imaging system captures the cooling rate, heating rate and peak temperature in real-time. LHT experiments are conducted with thermal monitoring to understand and correlate microstructures, hardness and hardening depth. Single-track laser heat treated samples of AISI 1020 low carbon steel are examined to evaluate the observed thermal history with different input process parameters. Microstructural characteristics such as martensite formation and phase transformations are studied based on the real-time values of the cooling rate, heating rate and peak temperature. Moreover, the hardness and hardened depth are also correlated with the substrate's thermal dynamics to identify a suitable feedback signal for closed-loop control of the depth. Finally,

[1] Corresponding author