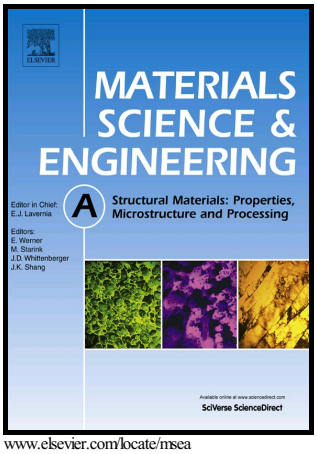
Influence of laser surface hardened layer on mechanical properties of re-engineered low carbon steel sheet

Badirujjaman Syed, Sulthan Mohiddin Shariff, Gadhe Padmanabham, Shaumik Lenka, Basudev Bhattacharya, Saurabh Kundu



www.elsevier.com/locate/msea

PII: S0921-5093(16)31622-7
DOI: http://dx.doi.org/10.1016/j.msea.2016.12.124
Reference: MSA34555

To appear in: *Materials Science & Engineering A*

Received date: 6 December 2016
Accepted date: 30 December 2016

Cite this article as: Badirujjaman Syed, Sulthan Mohiddin Shariff, Gadh Padmanabham, Shaumik Lenka, Basudev Bhattacharya and Saurabh Kundu Influence of laser surface hardened layer on mechanical properties of re engineered low carbon steel sheet, *Materials Science & Engineering A* http://dx.doi.org/10.1016/j.msea.2016.12.124

Influence of laser surface hardened layer on mechanical properties of re-engineered low carbon steel sheet

Badirujjaman Syed*, Sulthan Mohiddin Shariff, Gadhe Padmanabham**, Shaumik Lenka*, Basudev Bhattacharya*, Saurabh Kundu***

* R&D Division, Tata Steel Ltd., Bistupur 831001, Jamshedpur, India

** Center for Laser Processing of Materials, ARC-International, Balapur, RCI Road, Hyderabad 500005, India

Corresponding author: Dr. Badirujjaman Syed

Email address: b.syed@tatasteel.com or bsyed2010@gmail.com

Keywords: Laser surface hardening, Hardness, Tensile properties, Surface texture, Elastic modulus

Abstract: In the present work, a C-Mn low carbon automotive steel sheet has been used for laser surface hardening treatment. The steel sheet has been successfully surface hardened using high power diode laser up to certain depth (250-300μm) to make layered composite structure through its thickness. The microstructure of the treated layered steel sheet have been evaluated by different characterization techniques such as optical microscopy, scanning electron microscopy, X-ray diffraction. The hardness at the treated surface improved significantly (133-145% increase as compared to base hardness) due to formation of harder phases, which are identified as a mixture of martensite, bainite and prior-ferrite using EBSD technique. The tensile property of the layered steel sheet was also evaluated and found to yield significant improvements in both Yield Strength (YS) (25-40%) and Ultimate Tensile Strength (UTS) (20%) due to the sandwich effect of a composite layer constituting hardened layer and base accomplished by a strengthening mechanism associated with rule of mixtures concept. Correspondingly, the Young's modulus of the layered steel sheet determined from the slope of tensile stress-strain diagram was also found to be consistent with ultrasonic test results. Additionally, the crystallographic texturing effects