Faculty of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

HOCHSCHULE BREMEN
UNIVERSITY OF APPLIED SCIENCES

Master 2013

Rohan Rajput

Effect of Process Parameters on the Residual Stresses and on the Fatique Strength of Laser Cladded and Heat-treated Specimen.

ABSTRACT - Masterthesis

The number of laser cladding applications is increasing continuously. Despite its application is highly desired for cyclically loaded components it must not be applied for these parts of their fatigue strength can be influenced. Depending on the material system a significant drop of fatigue strength could be observed for parts processed with conventional process speeds.

In this work the common base materials 42CrMo4 and X5CrNi18-10 cladded with the Co-based superalloy Stellite 21 are to be regarded. It is to be investigated in how far the approaches of elevated process speeds and post heat-treatment by laser radiation can be used to optimize residual stresses and fatigue strength. For both approaches process windows need to be determined experimentally. Residual stresses induced by the respective temperature cycles are to be approximated by an analytical model available from literature. The model is to be adapted to local heat input and is to be verified by residual stress measurements gained by neutron diffraction of components processed at conventional speeds. On this basis residual stresses resulting from elevated process speeds are to be calculated. Results from parameter studies and the analytical model are to be correlated to determine one set of parameters for both approaches to be applied on fatigue test as well as tensile test specimen.

Fatigue and tensile tests will be performed. It is to he evaluated in which way fatigue strength is influenced by the residual stresses and if these can be influenced by the cladding process parameter.