Instrumentation of the hot cracking phenomena in iron based hard facing weld NOREM02

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Abstract

NOREM02 is an iron based hard facing weld used in the nuclear industry as wear resistant hardfacing in replacement of StelliteTM. However, NOREM02, as other FCC alloys, can be susceptible to hot cracking phenomena caused by solidifications defects, a ductility drop and residual stress due to the welding process. The aim of the study is to develop a new grade using an inoculant to modify the chemical composition to inhibit the columnar network and to control ferrite content. Then its susceptibility to hot cracking with standard NOREM02 is compared. To do so, two mechanical tests, representative for welding classified in ISO standards, are fully instrumented to obtain coupled thermo - mechanical fields along the specimen with high precision. A first CMOS camera uses the near infrared thermography (NIRT) or a visible bichromatic measurement to image the thermal field. The second camera acquires images for digital image correlation (DIC) to measure the displacement and calculate the strain field on the surface of the specimen. The first test is a hot tensile test performed on a Gleeble® simulator to characterize the ductility dip cracking of the alloy. The second test is a PVR-test in which a flat tensile test is carried out simultaneously with a welding process at a linearly increasing speed. Microstructure on post mortem samples will be study to achieve a better comprehension of the hot cracking phenomenon. In the end, a hot cracking criterion based on the study results will be suggested for simulation.

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