Residual stresses in bimetal designed for geothermal applications

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Keywords: X-ray diffraction; XRD2; explosive welding; bimetal

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Abstract

Residual stresses exist in material independently of the presence of any external loads. Their presence may not be readily apparent and so they may be overlooked or ignored during a process of engineering design. This, however, can cause great design risk because they can have profound impact on material strength, dimensional stability and fatigue life. Almost all manufacturing processes create residual stresses that can further develop during service life of the manufactured component. In this article we utilize concept of two-dimensional X-ray diffraction (XRD^2) and demonstrate its applicability on determination of residual stresses in a bimetallic duplex/ferrite steel system. The material system was prepared by explosive welding and has been designed for applications operating in highly-corrosive environment of geothermal power plants e.g. within vessels, piping heat exchangers, condensers etc. Our analysis is based on X-ray micro-diffraction experiments utilizing hard monochromatic X-rays focused down to micrometer size. In this way bimetal in bulk form was analysed moreover microstructural differences between the joined materials and their interface were determined by microscopy. Some brief attempt to determine status of weld by Barkhausen Noise Analysis method (BNA) was made. Too.

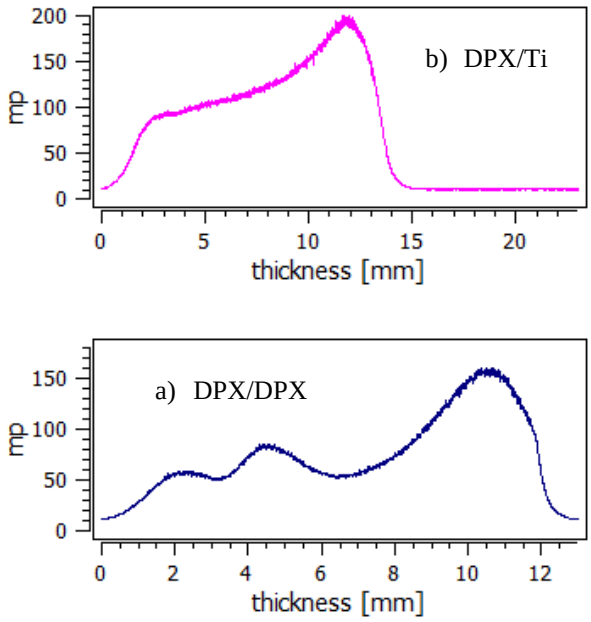

Figure 1 Ploted results along crosssection of cutted welded sheets.

Acknowledgement

Karel Saksl, Katarína Šuľová, Michaela Šuliková, Miloš Fejerčák and Zuzana Molčanová are grateful to the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences (VEGA project No. 3/0013/19) and to the financial support of the Slovak Research and Development Agency under the contracts No. APVV-15-0202 and APVV-17-0008. This work was realized within the framework of the project „Research Centre of Advanced Materials and Technologies for Recent and Future Applications „PROMATECH", ITMS 26220220186, supported by the Operational Program "Research and Development" financed through the European Regional Development Fund. We thank Diamond Light Source for access to beamline I15 under proposal number NT18273.

Łukasz Ciupiński, Michał Gloc and Zygmunt Szulc are acknowledging the financial support from Polish National Centre for Research and Development through grant no. M-ERA.NET/2013/01/2015