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Preface

Special Issue of the HIDA-8 Conference, 20–22 April 2021

The HIDA-8 Conference held online on 20–22 April 2021 was the eighth in the series of the HIDA international conferences held in various countries since April 1998. This series of conferences emanated from the European Commission (EC) project ‘HIDA’ (High-temperature Defect Assessment). The EC and European high temperature industry jointly funded the project which was mainly aimed at unifying European defect assessment procedures with validation on a number of materials of interest to power and process plant. Assessment of the behaviour of high temperature plant components containing incipient or service induced defects/cracks and operating under steady and/or cyclic load conditions has been an area of interest for some time. This type of assessment helps plant operators to make safe and cost-effective run/repair/replace decisions, and the HIDA conferences, initiated and headed by Dr. Shibli of the European Technology Development, UK, who headed the HIDA project, have now become a regular feature aimed at addressing this need. The first HIDA conference (HIDA-1) was held in Paris in April 1998 and was considered to be a highly focused event. The HIDA-2 conference was held in Stuttgart, Germany, at the end of the 4-year HIDA project. HIDA-3 was held in Lisbon, Portugal, and was aimed at crack growth and other high temperature behaviour of repair welds. HIDA-4 was held at the University of Cambridge, UK, and aimed at bringing together experts, academics, researchers and industry personnel interested in assessing the behaviour and life of defect-containing components using probabilistic assessment. HIDA-5 was held at the University of Surrey, UK, and considered a wider scope including Fitness-for-Service and Risk-Based Inspection (RBI). HIDA-6 was held in Nagasaki, Japan, in December 2013 and encompassed high temperature plant experience including experience with the new steels such as ASME P91 and P92 and creep-fatigue interaction. HIDA-7 was held in March 2017 at the University of Portsmouth, UK, and covered life and crack assessment of industrial components including costs and benefits of life extension of older plants when operating both in base-load and flexible modes.

Due to COVID-19, since the start of 2020 organisation of large face-to-face international conferences became prohibitive limiting the exchange of knowledge, data and discussions on many new and exciting developments over the past few years, hence the innovative idea of organising the online HIDA-8 conference. The conference was attended by about 100 delegates from around the world. In total thirty-one papers were presented, covering crack assessment, repair and inspection, monitoring of cracks and the pre-crack creep cavitation damage.

Session 1 entitled ‘Inspection, damage and cracking under creep, fatigue and oxidation conditions’ had ten papers in total, three of which are included in this issue. These are papers by Scheepers, Nikbin and Brune et al. The Scheepers and Bezuidenhout paper from Eskom, South Africa, discusses the assessment of defects in turbine casings under transient thermal loading and the acceptability of such defects. Two case studies are presented here, the first one dealing with the weld repair defects in a high pressure turbine outer casing and the second case study dealing with low pressure turbine bypass valves and the criticality of pre-warming to reduce transient thermal stress and by extension crack stress intensities during trips or shutdowns. The paper by Alang and Nikbin discusses creep, fatigue and creep-fatigue crack growth behaviour of ASME P92 steel, a relatively new steel used in the modern generation of fossil power plant, at 600 °C. Creep-fatigue crack growth behaviour is particularly important in light of the increasing intervention of renewables that are making the operation of back-up fossil power plant in flexible mode ever more frequent. The paper by Brune et al. makes an interesting comparison of the crack growth threshold and fatigue crack growth behaviour of wrought and additively manufactured IN718.

Session 2 entitled "Defects/cracks and life assessment" had eleven papers in total of which six appear in this issue. These are papers by Holdsworth, Yokobori, Scheepers, Brear, Trzeszczyński and Wojcik. The paper by Holdsworth is about creep crack growth (CCG) in γ' strengthened cast nickel-based superalloy Alloy-939. Here the CCG rates determined in terms of apparent stress intensity factor are re-evaluated as a function of the time-dependent C^* parameter. The paper by Yokobori Jr. et al. discusses creep and fatigue crack growth in ASME P92 steel base and weld metals in terms of the correlation of deformation with damage progression behavior around a notch tip. The Scheepers and Bezuidenhout paper presents two case studies that demonstrate the effect of bolt pre-load on creep and fatigue lives as well as on the acceptability assessment of defects. In his paper, Brear discusses the Wilshire Equations introduced over 15 years ago and compares the predictions made using the original and developed models with the actual materials behaviour and discusses aspects of the methodology which, in his view, requires reconsideration. The paper by Trzeszczyński discusses the company's experience with power plant component damage detection and run/repair/replacement decision-making. The paper by Wojcik, Santos, Waitt and Shibli discusses the use of DC and AC potential drop methods for the detection of creep cavity damage in P91 steel components operating under creep conditions.

Session 3 entitled 'Martensitic steels – cracking, life assessment and modelling' contained six papers, only one of which is published here. This paper by Tonti et al. describes efforts being made in Italy in standardising inspection and life assessment of high Cr martensitic steels, especially ASME P91 and P92 steels which are more difficult to inspect as creep cavitation in this steel type is difficult to detect by the standard methods used for low alloy steels for high temperature plant. This is due to the very small size (nano or a few microns level) of creep cavitation that occurs in this steel type until very late in life, ~70 to 80% of life, when it may be too late to stop the component failure. This paper describes laboratory tests and detailed microstructural analyses that were carried out on P91 and P92 steels for the realisation of a reference atlas on microstructural modification and precipitates evolution during isothermal ageing and creep.

The conference closed with an online discussion in which all participants were given the opportunity to participate, making it as close to a face-to-face conference as possible.

We hope that you find that the contents of this special issue represent a good combination of research papers and industry experience that are of particular interest and benefit in the understanding of high temperature industry issues.

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