A numerical-experimental investigation of Alloy 800H: application to high temperature systems

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The aim of this PhD is to explore the applicability of assessment codes in estimating the high-temperature behaviour of Alloy 800H and its variations, identify their limitations and offer modern numerical solutions to increase their reliability.

The complexity of nickel alloys compared with relatively simple stainless-steel behaviour does not allow the direct transformation of current procedures to Alloy 800H. While Alloy 800H is widely used in high temperature applications, its usage so far has been (a) cast specific with no two casts behaving similarly (b) mostly applied in easily reparable or replaceable assets, thus the straightforward, over-conservative ASME bilinear curve for creep-fatigue interaction has been the most-used design and assessment rule.

We aim to undertake a programme of work which explores the behaviour of Alloy 800H at two different length scales experimentally: meso-scale and macro-scale. This PhD project will deal with the lower length scale analysis that is required for informing meso-mechanical simulation work through experimental techniques such as high angular resolution electron back scatter diffraction and synchrotron X-ray diffraction. This will involve characterisation of the gamma prime nano-precipitates formation by scanning transmission electron microscopy (STEM), and dissolution at relevant temperature; identifying the interaction of the dislocations with the precipitates in terms of pinning, glide, and climb; the validation of the deformation model at grain scale via HR-EBSD and HR-DIC.