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Influence of residual stresses on thermo-mechanical fatigue in turbine housings

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This poster presents the results of a neutron investigation of the residual stresses generated during the production of the turbine housing component of a turbocharger with the aim of improving simulation methodologies to predict the locations of thermal fatigue and fracture locations and hence improve the performance of the turbochargers.

Initial strain measurements were made on ENGIN-X (Rutherford Appleton Laboratory, UK) on three turbine housings selected from various stages in the manufacturing process. Measurements were made on a region of the housing where failures (cracks) have been recorded after accelerated durability tests, although these have never been predicted by FEA. Measurements were also made using SALSA (ILL, France) on two turbine housings, one as cast and one heat treated. In this experiment the internal divider wall was examined in detail as this is an area where crack initiation can occur during operation. Our results show that heat treatment can reduce compressive residual stresses. However, as compressive stresses are thought to slow the onset of crack initiation and could be beneficial in the material, questions about the efficacy of current production methods have now been raised.

These results will be compared with the results of FEA simulations, and suggestions for modifying the simulation methodology and/or production route will be discussed.

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