

In-situ Strain Measurements in Composite Castings using Neutron Diffraction

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Abstract

Due to different thermal expansion of the casting material and the material of the insert residual stresses occur during solidification of composite castings. These residual stresses can reduce fatigue strength and lead to distortions of the part. They can be minimised by constructive measures. Casting simulation is a suitable method to predict residual stresses and distortions and thus to optimise design of parts. To improve the accuracy of stress simulation composite castings were investigated experimentally using conventional strain gauge methods and neutron diffraction. The use of neutron diffraction enabled to obtain, non-destructively, stress distributions within the bulk of the specimen. In-situ neutron diffraction strain experiments during solidification of the composite castings made it further possible to measure thermal and mechanical strains up to solidus temperature of the casting material. The results are used to verify and optimise the residual stress simulation. In the end this enables an optimised construction of composite castings.