

## **EMMC Translation case: Residual Stresses and structural changes generated at different steps of the manufacturing of gears: Modelling and Validation.**

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Banded ferrite-pearlite structures, and in general chemically inhomogeneous structures, react non uniformly to elevated temperatures during forging and/or subsequent heat treatment processes, affecting the final stress state (plastic deformation is required to accommodate dissimilar thermal expansion behavior for each phase) and consequently leading to distortions. These unpredicted distortions are one of the major causes of rejected components that need to be reworked, leading to production losses. In this translation case, modelling of the tensional and microstructural state of gears at the different manufacturing steps (forging, normalizing, quenching and tempering), as well as dimensional characterization is performed in order to determine the origin of distortions of parts. The main expected outcome was to evaluate the use of simulation tools to gain more insight about the effect of the different production stages on material microstructure, final dimensional accuracy and physical properties of gears, prior to perform the sequence of treatments on the industrial component. The type of model proposed was a continuum based on FEM simulations of heat treatment processes on forged gears, considering the commercial software SYSWELD which provided the required information connected to the effect of those treatments on the residual stresses and hardness of the component. The industrial application requires the contribution of discrete models to be combined with continuum models. A 20-30% reduction (semi quantitative) in the time consumed in trial – and – error assays was reached by the consideration of the tools explored in this translation case.

### **REFERENCES**

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