

Modelling of composition and stress profiles in low temperature surface engineered stainless steel - DTU Orbit (08/11/2017)

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Thermochemical surface engineering by nitriding/carburizing of stainless steel causes a surface zone of expanded austenite, which improves the wear resistance of the stainless steel while preserving the stainless behavior. As a consequence of the thermochemical surface engineering, huge residual stresses are introduced in the developing case, arising from the volume expansion that accompanies the dissolution of high interstitial contents in expanded austenite. Modelling of the composition and stress profiles developing during low temperature surface engineering from the processing parameters temperature, time and gas composition is a prerequisite for targeted process optimization. A realistic model to simulate the developing case has to take the following influences on composition and stress into account:

- a concentration dependent diffusion coefficient
- trapping of nitrogen by chromium atoms
- the effect of residual stress on diffusive flux
- the effect of residual stress on solubility of interstitials
- plastic accommodation of residual stress.

The effect of all these contributions on composition and stress profiles will be addressed.

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