

# Enamelling simulation capabilities

Corus offers an advanced analysis technique for the enamelling process and the in-service performance of the enamelled product. Corus is able to support customers using this analysis approach even before prototyping.

## Why enamelling simulation

Enamelling is one of the last steps in the production of an enamelled part. Any failure can result in high design and tooling change costs, with an increase in time-to-market. Using simulations it is possible to predict failure in an early stage of the product development process.

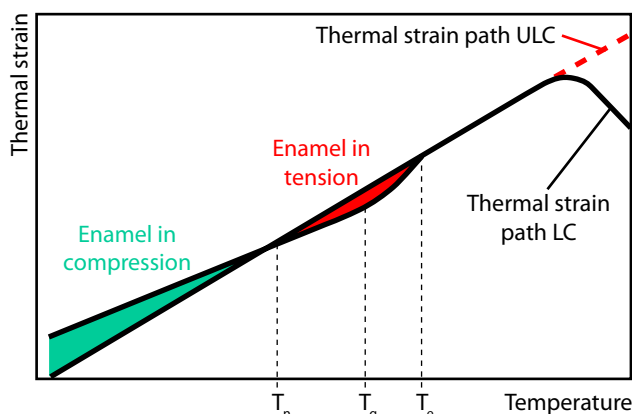
## What we offer

Corus has a tool available, which is capable to simulate the process numerically, even before prototyping or ordering mass production tools. The influence of process conditions and/or the combination of several steel grades in an application can be investigated in advance. Furthermore the in-service performance of the application can be examined taking the residual stresses of steel and the enamel layer into account.

## Case study

The residual stresses of steel and the enamel layer are a result of differences in temperature dependent material behaviour for both materials.

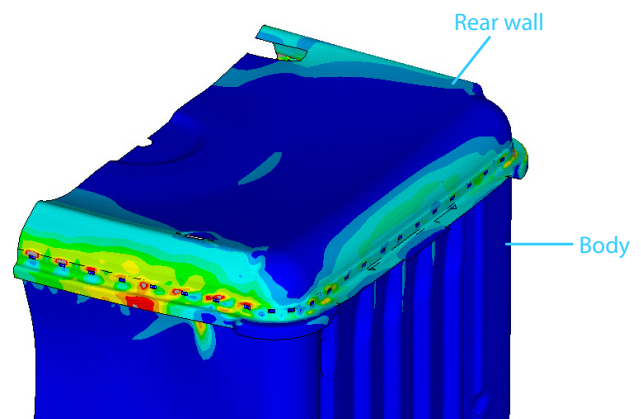
In case an assembly is made of several steel grades differences in thermal strain path between the grades can occur due to phase transformation of one of them. This will also introduce residual stresses.



Thermal strain paths of the materials

These differences in material properties can lead to permanent shape distortions in the application. This is caused by the decreasing strength of steel at high temperatures.

For example, in the assembly below the body and rear wall are made of two different grades. The picture shows the distortions in the spot-weld areas after the enamelling process due to this effect. In this case it results into the shape distortion of the rear wall.



Plastic deformation in spot-weld areas

At room temperature the stresses inside the enamel layer are compressive and consequently inside the steel sheet mostly tensile. The obtained stress levels in the materials are important for the in-service performance of the product. Failures (cracks) in the enamel layer induced by mechanical or thermal loads can occur if the stress level is not appropriate.

## Benefits

- Investigation, diagnosis and recommendations for solving enamelling issues.
- Recognizing possible problems already in the design phase.



Corus Research, Development & Technology  
Automotive Applications  
3H-36  
P.O. Box 10.000  
1970 CA IJmuiden  
The Netherlands

PHONE  
FAX  
EMAIL  
WWW

automotive.applications@corusgroup.com  
www.corusautomotive.com

+31 (0)251 498276  
+31 (0)251 470432

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