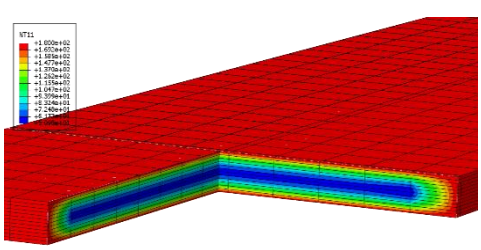
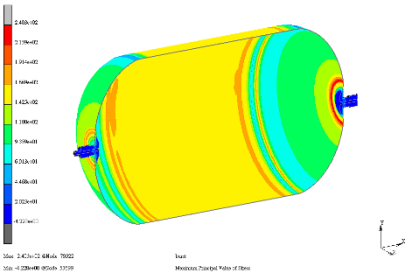
Technische Universität Braunschweig

Institut für Flugzeugbau und Leichtbau
IFL

Studienarbeit





Topic	**Exploring the role of degree of cure in residual stresses during curing for composite structures**
Technical focus	Curing kinetics, composite structures, heat transfer, FEM
Contact person	Ivan Komala, IFL Raum 027 i.komala@tu-braunschweig.de | Tel. 0531 / 391 9918
Requirements	• Fundamental knowledge in composite structures and heat transfer • Basic knowledge in Matlab/Python, FE software (preferably Abaqus), and FORTRAN • Fluent spoken and written in English

The significance of temperature distribution in composite structures is critical in hydrogen storage, which has an extreme operational temperature and presumably thicker composite laminates. During the curing process, the degree of cure (DOC) influences the thermal properties of the material, such as thermal conductivity and specific heat capacity. These properties, in turn, affect how heat is distributed throughout the structure, leading to variations in curing rates at different points. Such non-uniform curing can result in additional residual stresses that compromise structural integrity and dimensional stability.

To address these complexities, a user-defined material subroutine (UMATHT) can be developed to link the DOC with thermal properties, to achieve a precise temperature distribution during curing. In addition to the residual stresses caused by chemical shrinkage, this approach allows for detailed analysis of how curing-induced residual stresses develop due to uneven temperature profiles and varying curing times across the structure.

Tasks:

- Literature review for degree of cure (DOC) dependent thermal properties
- Implement a user subroutine for material conductivity and specific heat to the FE model
- Model verification with previous studies
- Analyze the influence of DOC-dependent thermal properties in temperature distribution for composite plates with different stacking sequences and thickness

07.03.2025