

# Characterization of complex pore networks in carbon preforms of MiCa-SiC ceramics on the basis of X-ray computed tomography

R. Jemmali\*, S. Weber, D. Koch

Department of Ceramic Composites and Structures, Institute of Structures and Design, German Aerospace Center (DLR), 70569 Stuttgart, Germany

## Introduction

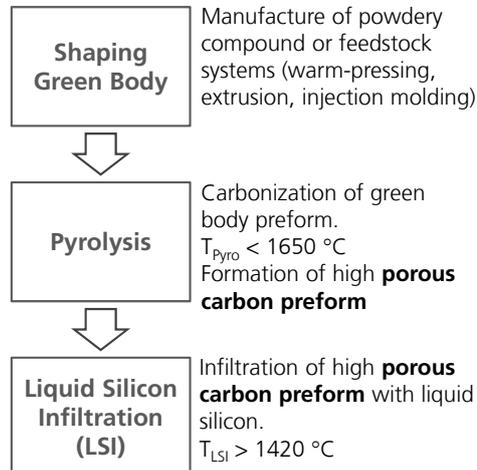
The microstructures of MiCa-SiC ceramics (Metal infiltrated Carbon SiC) depend on the pore morphology of their carbon preforms.

It is possible to adapt MiCa-SiC to diverse industrial applications by regulating the material phases and properties.

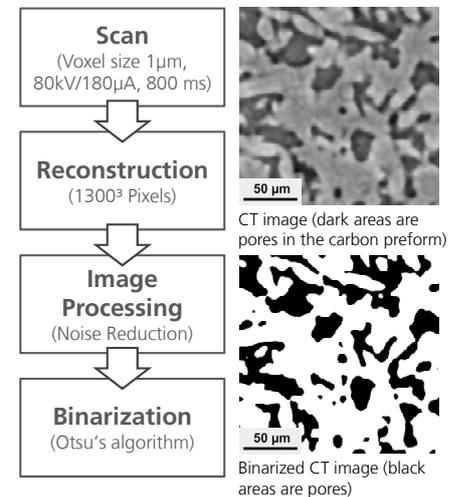
The pore network of the considered material can be characterized efficiently by combination of high resolution computed tomography (CT) and adequate image processing algorithms.

## Experiments

### I. Manufacturing of MiCa-SiC

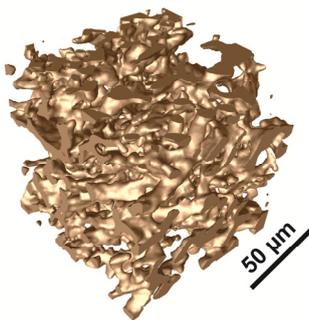


### II. CT Workflow

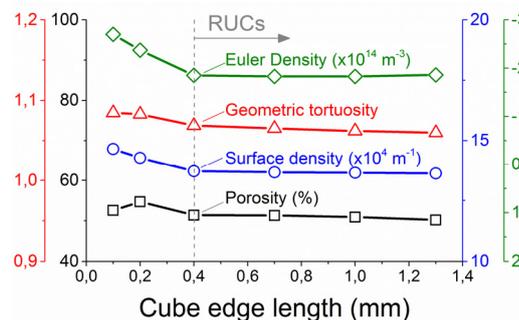


## Results

### I. Determination of a Representative Unit Cell (RUC)

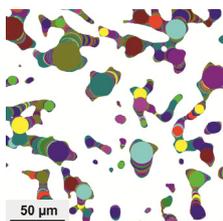


Surface rendering of the pore network in a portion ( $100^3 \mu\text{m}^3$ ) extracted from the reconstructed volume ( $1300^3 \mu\text{m}^3$ )

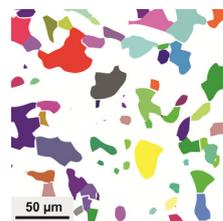


- Computation of adequate morphological and topological parameters
- Investigation of their variation in function of the 6 different volumes
- Volumes with an edge length between 0,4 and 1,3 mm seem to be representative

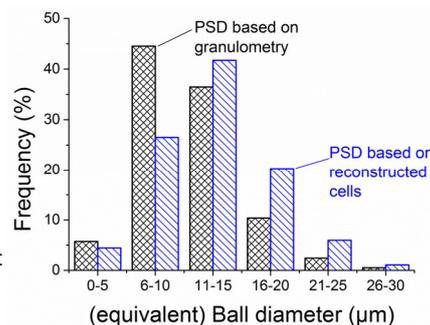
### II. Pore Size Distribution (PSD)



**1. Granulometry:** Maximal inscribed sphere for each voxel in pore network.



**2. Cells reconstruction:** Segmentation of pore networks into regions.



- PSD from CT based methods show a certain similarity
- Both distributions were determined at a RUC with an edge length of 400 μm

## Conclusions/Outlook

- Both methods, granulometry and cells reconstruction, provide useful information about the PSD in the carbon preforms
- A Representative Unit Cell (RUC) can be defined using specific volume properties. The knowledge of the RUC reduces effectively the numerical effort when performing simulations (e.g. CFD) based on geometries extracted from CT data
- The suitability of further methods (e.g. pore-throat-models) is under investigation
- The PSD based on CT data will be correlated with other experimental methods (e.g. Mercury Intrusion Porosimetry)