Essay summarizing the scholarship period

Introduction

The objective of this study visit was to establish a solid basic knowledge of the Micro-Computed Tomography (micro-CT) technique. During my scholarship, I have received one-to-one training in sample preparation, instrument operation, data processing, and analysis. Special emphasis was given to the use of micro-CT in advanced ceramics technology for the quantitative assessment of pores, cracks, and other manufacturing or usage related inhomogeneities.

Timeframe (12.06-27.06.2022)

I was introduced to the staff of the Interdisciplinary Excellence Centre, Department of Applied and Environmental Chemistry, University of Szeged by giving a talk about my scientific background. The experienced micro-CT operator was assigned to guide me through a training process. The CT laboratory was shown to me, and I was provided with theoretical knowledge and principle of CT technique in this timeframe.

Timeframe (27.06-11.07.2022)

The practical training started in this period. The process of sample preparation was explained and demonstrated. Further, the start-up and shutdown process of the CT was shown to me. I have prepared several samples of alumina ceramic for CT analysis. Part of them was in a "green state" not sintered, while the rest of the samples underwent the sintering process. The purpose of this was to compare two sets of samples by determining their morphology (porosity, presence, or absence of cracks etc.) using the CT technique. The CT working parameters were carefully determined and set to obtain valid scans. The logic behind the selected operating settings was explained by the instructor (CT operator).

Timeframe (11.07-25.07.2022)

The remaining samples were successfully scanned. After obtaining valid scans of prepared samples, I was familiarised with 3D image reconstruction of collected data in CTVox software. The reconstruction process was time-consuming due to the high processing power needed. An example of a 3D reconstructed image of the sample is provided in Figure 1. The meticulous analysis of collected data to determine the morphological properties of the samples was started. Previously, user tutorial was provided including the additional user manuals to further expand the knowledge of software capabilities.
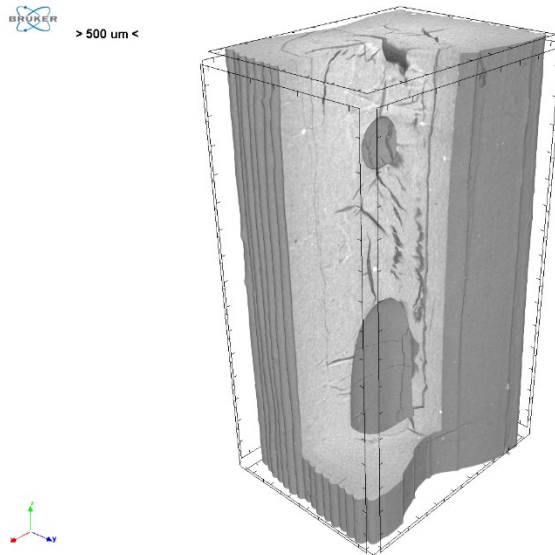
Figure 1. The 3D image of the alumina sample after sintering reconstructed by CTVox software.

Timeframe (25.07-12.08.2022)

The morphological analysis of the collected data was continued in CTAn software. All scanned samples were completely analysed in order to determine morphological properties such as shape, structure, and open/closed porosity. The distribution of porosity throughout the alumina sample is demonstrated in Figure 2. as an example.
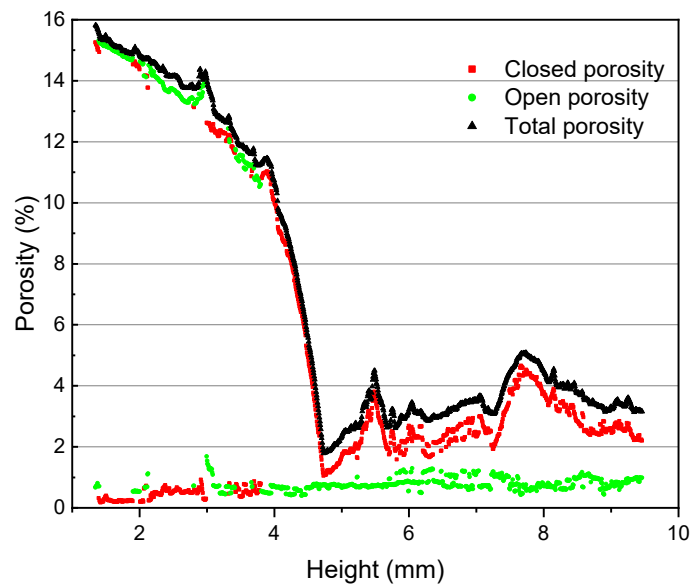

Figure 2. Porosity in function of the height of the sample

Concluding remarks

The short study visit resulted in the transfer of knowledge in using micro-CT technique for analysis of various samples with a special focus on advanced ceramics. The strong foundation for further collaboration between the host institution and visiting researcher has been established.