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XRI1015 - Observation of lyophilized formulations by micro X-ray CT

Introduction

3D structural observation of lyophilized formulations, also called “cakes,” is important for optimization of the composition of additives and the lyophilization process. Many cakes must be observed in vials because their 3D structures change due to moisture absorption. X-ray CT imaging shows the 3D structure of a sample by utilizing the ability of X-rays to penetrate materials, which allows observation of the fine internal structure of a cake sealed in a vial. In this example, micro X-ray CT was used to scan a cake in a vial to observe the state of the solids and voids inside the cake.

Example of measurement and analysis

A CT scan of a cake in a vial (Figure 1) was performed with a resolution of 9 $\mu\text{m}/\text{voxel}$ to examine the solids and voids of the cake structure in the cross-section images (Figure 2). Next, we made a cross-section image at the red line position and displayed the 3D image (Figure 3). The cross-section and 3D images show that there are two different types of regions with different shapes and void sizes. Also, large voids that extend from the center of the cake to the right side in the vertical direction of the vial were observed. For cakes that can be removed from the vial for scanning, CT images can be acquired with a resolution of 1.3 $\mu\text{m}/\text{voxel}$ if the cake can be cut and prepared.



Figure 1: Lyophilized formulation (cake)

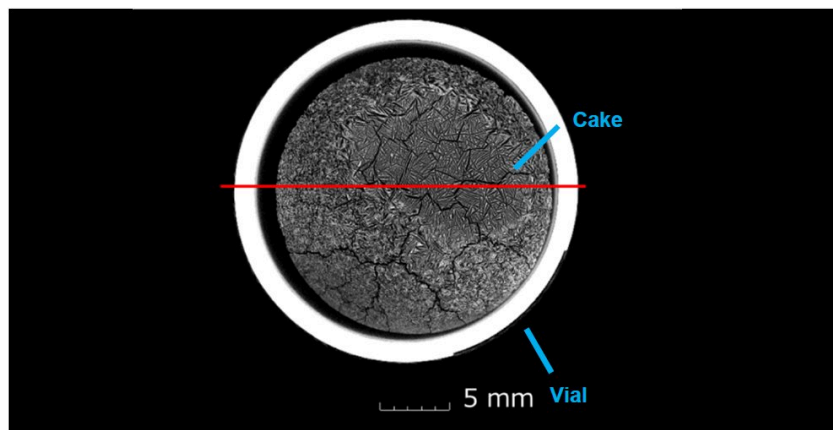


Figure 2: Cross-section image of the cake

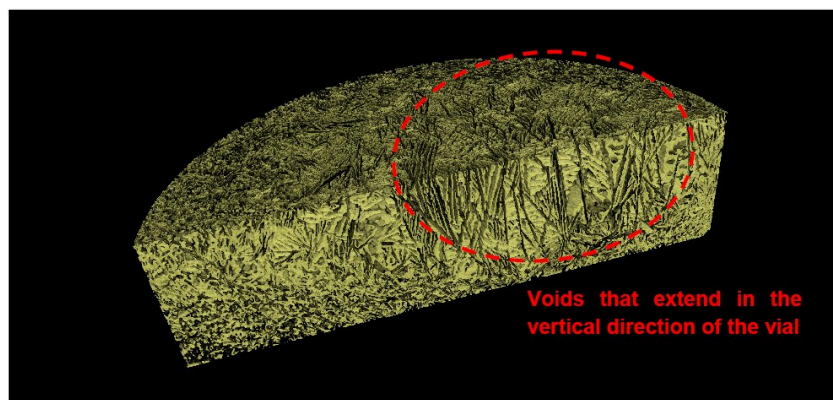
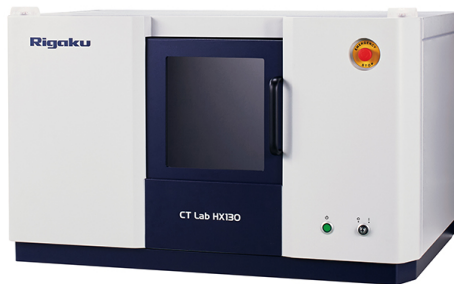


Figure 3: 3D image of the cake

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