Supplementary Material

Slicing – A New Method for Non Destructive 3D Elemental Sensitive Characterization of Materials

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With the method presented in this paper the three-dimensional distribution of elements in a sample can be measured. Since no reconstruction is necessary, for each element a three-dimensional data set with intensities is easily available.

A major challenge is the visualization of the measured data. In classical computed tomography for each voxel a value that represents the absorption is obtained. In the case of element - resolved measurements for each voxel and each element a signal is measured. As in the RGB system only three colors are available , but more elements are measured, usually each voxel consists of a mixed color, which is difficult to interpret .Anyhow, this proceeding is only feasible for three or less elements .

Therefore, we took another approach . A color was assigned to each element. In the presented example iron is red, green copper , calcium blue and zinc purple . In addition, the scattering signal is represented as a grayscale value .

To display the 3D distribution the scattering signal served as initial data set. Thus, the structure of the sample was represented. Then, the voxels were colored gradually. The sequence was by the number of voxels were the intensity for a given element was above a fixed threshold. In the present case this means that first Ca, Fe and Zn, and finally Cu was colored. By this order it was ensured, that the elements which were detected in only a few voxels are still visible. However, overlap may occur, so that the distribution of a single element is not displayed correctly. In the case of doubt, it is necessary to consult the distribution of the elements separately.

The 3-dimensional distribution is presented here in three films that were created in ImageJ :

- Movie 1 shows the sequence of measured layers. In each layer the distribution of elements is visualized by the method described above.

- Movie 2 is a representation of the point cloud

- Movie 3 is the rendered surface of the sample .