Quantitative electron tomography analysis of zeolites porosity

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Hydrocracking catalysts are bifunctional, consisting of a metallic function supported on an acidic support. In order to achieve a high activity, the support is commonly prepared by shaping a USY zeolite in amorphous binder. In order to generate new catalysts with higher selectivity, two design improvements can be performed on zeolites : decreasing the size of the elementary zeolite crystals and controlling the mesoporous network.
Electron microscopy is a proper technique to characterize zeolites. By transmission electron microscopy, microporosity and mesoporosity can be observed. It is necessary to use electron tomography to visualize the 3D organization of mesoporosity.
In this study, we applied electron tomography using Bright-field mode to compare the crystals morphology and 3D mesoporous network of nanoagregates of zeolites prepared by an alternative synthesis to the reference commercial USY zeolite. Advanced methods, based on mathematical morphology approach, were developped in order to provide quantitative data, such as porous volume, pore connectivity and accessibility. A workflow of image analysis (including reconstruction, 3D Flowing Bilateral Filter, segmentation, quantification) was thus processed on three USY zeolites. We will show that this method permits to outline differences in porosity accessibility and pore distribution.