Chair of Process Systems Engineering
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Growth of crystals tracked in 3D

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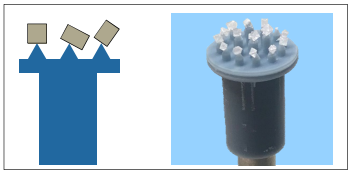
Motivation

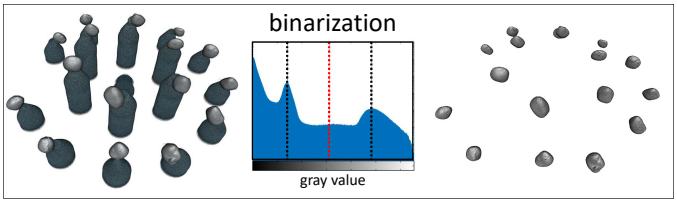
- Shape and size of crystals are usually tracked by 2D imaging
- Crystals are often hard to visualize with these methods due to their 3D nature
- Micro-computed computer (µCT) tomography enables detailed shape and size analysis[1,2]

Sample Preparation

- Potash Alum and Sucrose Crystals are glued to growth racks

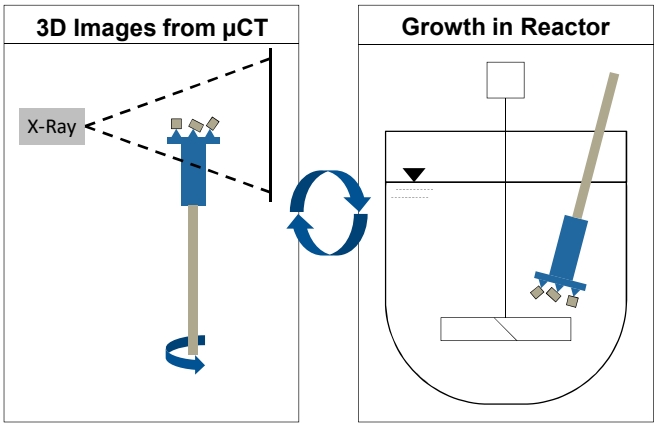


- 3D Images of the racks with crystals are obtained by µCT



Tracking Crystal Growth

- for µCT, 1600 X-Ray radiographies are combined to a 3D image
- voxel-spacing 8 µm, captured volume 2×2×1 cm^3
- 25 min per 3D image



- Growth/Imaging cycles repeated several times depending on the experiment
- Supersaturation in the reactor and the time for growth vary depending on the experiment

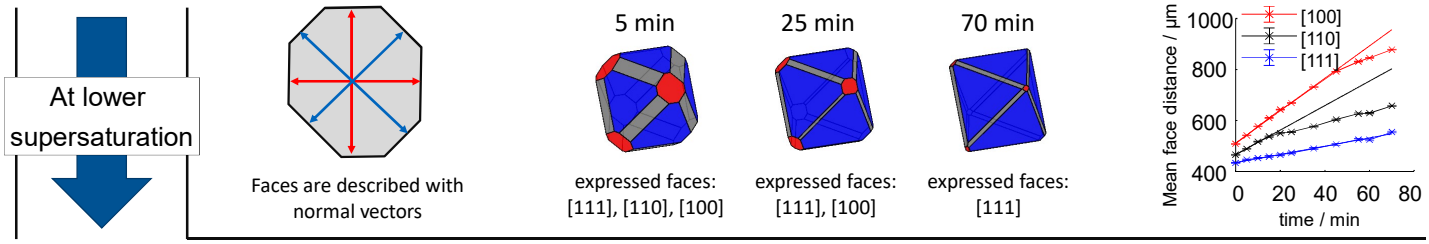
Results

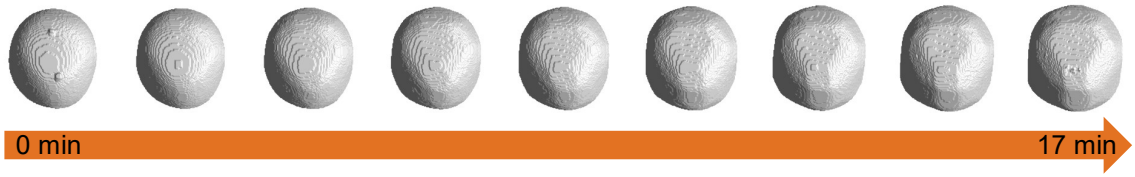
- Growth of abraded crystals tracked
- Round crystals become facetted quickly
- Fast growing faces disappear
- Transition from round to facetted tracked in detail

Geometric description through H-Representations[1]…

… for each time point…

… yields growth rates.





Curious?
Attend our presentation
Aug. 30th, 15:25
@Room 1: Kinetics I

Literature

[1] Schiele, Simon; Kovačević, Tijana; Briesen, Heiko (2020): Morphological Modelling and Simulation of Crystallization Processes. In Stefan Heinrich (Ed.): Dynamic Flowsheet Simulation of Solids Processes. Cham: Springer International Publishing, pp. 435–473.

[2] Schiele, Simon A.; Antoni, Felix; Meinhardt, Rolf; Briesen, Heiko (2021): Analysis of Nonideal Shape Evolution during Potash Alum Crystallization Using Microcomputed Tomography and Three-Dimensional Image Analysis. In Cryst. Growth Des. DOI: 10.1021/acs.cgd.0c01644.