Synchrotron diagnostic imaging of crystal growth processes

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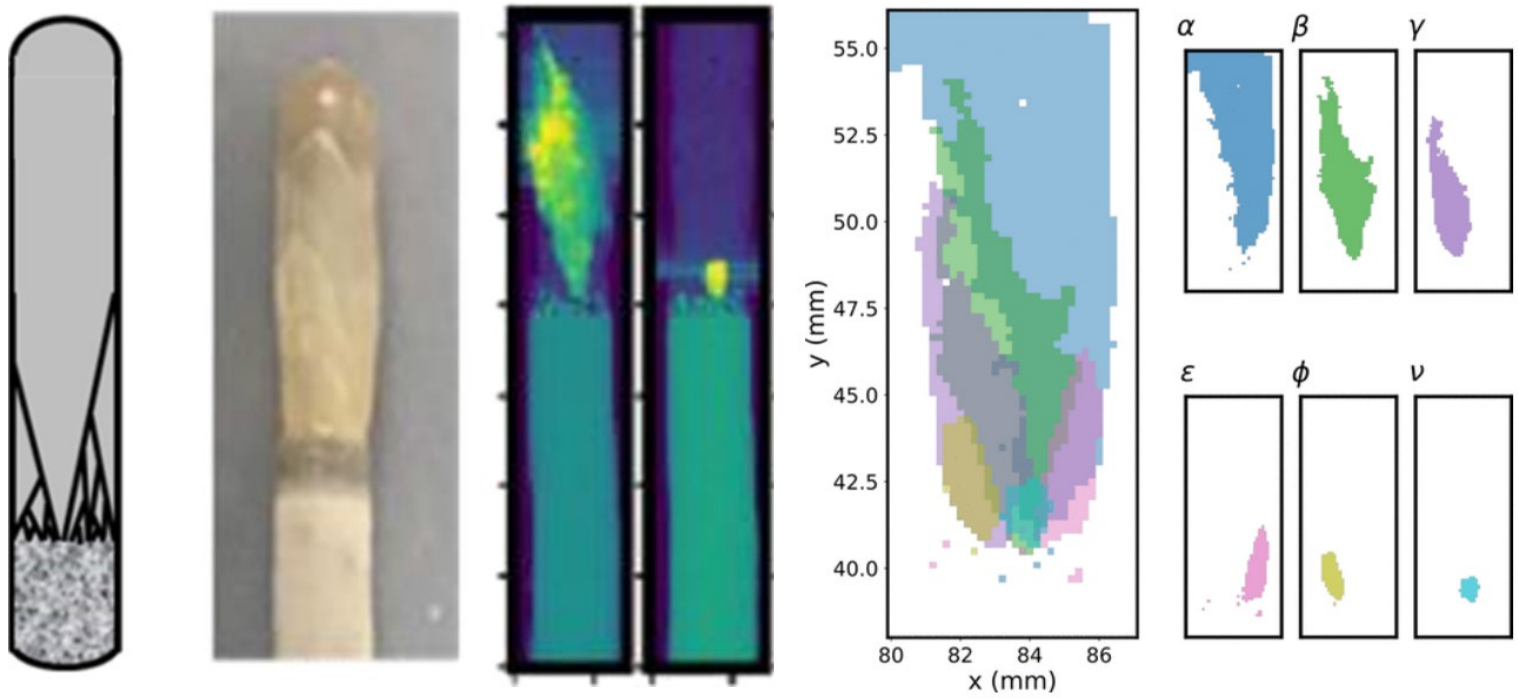
The optical floating zone (OFZ) method is one of the most versatile and important techniques for growing large single crystals needed for the study of emerging functional materials, such as those used exhibiting superconductivity, ferroelectricity, and energy conversion and storage.

Using a TiO_2 polycrystal-to-single-crystal boule **grown at PARADIM's bulk crystal facility**, Peter Khalifah and his team in the GENESIS EFRC demonstrated that high-energy synchrotron X-rays can non-destructively probe large OFZ boules to determine position, shape, orientation, and quality of individual crystals grains within the boule. While multiple grains grew large, one single winning grain (blue in the reconstructed map, α) grew faster than the other grains, terminating their growths while expanding to encompass the entire diameter of the top of the crystal growth boule.

The information provides direct access to grain formation and growth dynamics and will lead to improved models of crystal growth that accelerate materials development.



From left: schematic of grain nucleation and growth during the OFZ process, photograph of TiO_2 multicrystal grain from early in the seeding process, raw consecutive synchrotron grain maps, and reconstructed maps of grains and their evolution during OFZ growth, demonstrating the ability to directly visualize the OFZ seeding and growth process and dynamics.

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