

International Conference and Expo on Ceramics

August 17-18, 2015 Chicago, USA

Recent research on image crystals: Discovery of shape-controllable cavities surrounded by facets in ceramics

Hiroyuki Serizawa

Japan Atomic Energy Agency, Japan

Author's investigation on cavities in ceramics was triggered by the unexpected discovery of a polyhedral cavity in a UO_2 matrix. The SEM image that attracted author's attention was a cavity observed in the fracture surface of a single crystal of UO_2 that was heat-treated in helium at 90 MPa, followed by annealing at 1573 K for 1 h. It was clear that the cavity was a negative crystal that was formed by the precipitation of helium during heat treatment after Hot Isostatic Pressing (HIP) injection. In a series of experiments, it was noticed that the shape of the negative crystal changes depending on the heat-treatment history. In general, it is difficult to control arbitrarily the shapes of these polyhedral negative crystals embedded in a solid medium; however, the shape can easily be controlled using the helium injection method. Author's research team named the shape controlled negative crystal as image crystal. At this time, it was discovered that three types of image crystals formed in UO_2 . Further research was conducted on the formation of image crystals in CeO_2 . However, because of manufacturing difficulties, single-crystal CeO_2 is not available. Consequently, a CeO_2 thin film formed by epitaxial growth was used. Helium was injected as 130-keV He^{4+} ions from a 400-keV ion implanter. The helium-ion-doped film was heat treated at 1673 K for 2h. The sample was cut into rectangular slices for transmission electron microscopy. We confirmed that nanosized image crystals had been formed in the matrix.

Biography

Hiroyuki Serizawa obtained his PhD from Osaka University. He is a Research Scientist at the Japan Atomic Energy Agency. He was a guest researcher at the Joint Research Centre's Institute for Transuranium Elements, Germany (ITU) from 2000 for one year as a student sent abroad by the Ministry of Education, Culture, Sports, Science and Technology. He has published more than 50 papers in reputed journals. His work on image crystals will be published by Nova Science Publishers in the near future.

serizawa.hiroyuki@jaea.go.jp

Notes: