Contribution ID: **8** Type: **2. Invited speaker (by invitation only)**

Visualizing heterogeneous microstructures and defects in ceramics using synchrotron X-ray multiscale tomography

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Synchrotron X-ray multiscale tomography, combining micro- and nano-tomography, provides high-resolution 3D imaging of heterogeneous microstructures and defects in ceramics. This method reveals how powder heterogeneity, hierarchical structures, and complexity govern defect formation, reliability, and mechanical performance.

In multilayered ceramics, defects arise from raw powders or during tape casting, drying, thermo-compression, binder burnout, and sintering. Tape-cast alumina laminates show strength-limiting defects at layer interfaces and around large powder inclusions. Even uniform slurries exhibit heterogeneous particle packing, forming complex interconnected pores, while self-assembly of polyhedral alumina crystals can produce flake-like sheets for controlled 2D microstructures.

In high-purity submicron α-alumina, agglomerates and aggregates evolve into complex pores during sintering. Circumferential cracks form under matrix constraint, and fractography confirms these pores as fracture origins. Mechanical analysis using elliptical crack and pore-crack models explains the observed strength.

These studies demonstrate how synchrotron X-ray multiscale tomography links powder heterogeneity, processing, and strength-limiting defects, guiding the design of high-reliability ceramics.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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