



Prof. **Fumihiko Wakai**

Interdisciplinary Graduate School of
Science and Engineering
**Department of Materials
Science and Engineering**

Contact: 045-924-5361; wakai.f.aa@m.titech.ac.jp

Lab HP: <http://www.msl.titech.ac.jp/~dfc/>

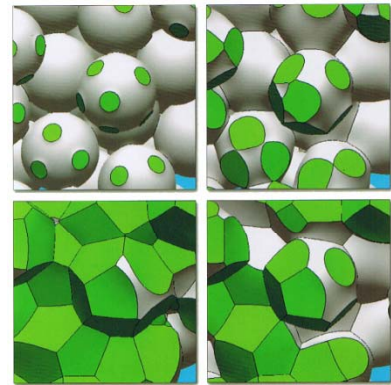
Research field: Ceramics Superplasticity



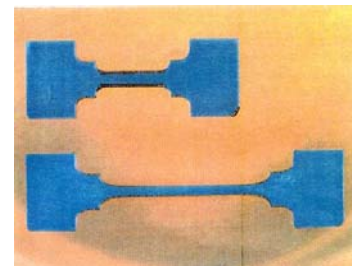
Research topics conducted within the G-COE project

1. Design for Secure Materials

Most ceramics are hard, chemically inert, and refractory. On the other hand, they are brittle in nature, and their strength is limited by microscopic defects. We aim to develop technology for increased reliability of ceramics, which will be key components for realizing safe and secure systems. The ductile ceramics is still a dream, but, the finding of Ceramics Superplasticity brought about a unique net-shape manufacturing method for future ceramic industry. The main challenges are to provide basis for developing highly efficient superplastic forming of toughened ceramics. Furthermore, we are developing modeling and simulation technology to find a solution for forming more reliable ceramic components by controlling nano-micro structures.



3D-simulation of sintering



Ceramics Superplasticity (Nature 1990)

Representative publications

- Anisotropic shrinkage induced by particle rearrangement in sintering; *Acta Mater.*, **55**, 4553 (2007).
- High temperature deformation of α -SiAlON nanoceramics without additives; *Scripta Mater.*, **56**, 871 (2007).
- Modeling and Simulation of Elementary Processes in Ideal Sintering; *J. Am. Ceram. Soc.*, **89**, 1471 (2006).
- Effect of Intergranular Glass on Superplastic Deformation of β -Silicon Nitride; *J. Euro. Ceram. Soc.*, **26**, 1069 (2006).
- Shrinkage and Disappearance of a Closed Pore in the Sintering of Particle Cluster; *Acta Mater.*, **54**, 793 (2006).
- Coarsening and Grain Growth in Sintering of Two Particles of Different Sizes; *Acta Mater.*, **53**, 1361 (2005).
- Methods to Calculate Sintering Stress of Porous Materials in Equilibrium; *Acta Mater.*, **52**, 5621 (2004).
- Sintering Through Surface Motion by the Difference in Mean Curvature; *Acta Mater.*, **51**, 4013 (2003).
- Equilibrium Configuration of Particles in Sintering Under Constraint; *Acta Mater.*, **51**, 641 (2003).