

# Engineering & Scientific Consulting

# Charles Smith, Ph.D.

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#### **Professional Profile**

Dr. Smith is a materials scientist and engineer who specializes in the synthesis, processing, and characterization of inorganic and ceramic materials. His research experience has focused on the evaluation and design of materials subjected to extreme environments including high temperatures, stress, radiation, and corrosion. He is an expert in the mechanical behavior of ceramics and metals, a variety of microstructural characterization techniques, as well as inorganic material fabrication and processing methods. He also has industrial research and development experience and understands the development of materials and products from a manufacturing perspective.

Dr. Smith has extensive experience with materials characterization methods including scanning electron microscopy (SEM), transmission electron microscopy (TEM), focused ion beam (FIB) milling, energy dispersive x-ray spectroscopy (EDS), electron backscatter diffraction (EBSD), x-ray diffraction (XRD), optical microscopy, thermogravimetric/differential thermal analysis (TGA/DTA), x-ray fluorescence (XRF), dynamic light scattering (DLS) particle size measurement, and BET surface area analysis. Additionally, Dr. Smith has experience with mechanical characterization of materials across a range of length scales, including micro- and nanoindentation, in situ SEM and TEM deformation, fatigue testing, and fracture toughness quantification.

Prior to joining Exponent, Dr. Smith completed his Ph.D. at the University of Illinois at Urbana-Champaign where his research focused on mechanical and microstructural characterization of ferroelastic deformation in ceramics, as well as spark plasma sintering of refractory materials. After completing his Ph.D., Dr. Smith then spent five years working in the Corporate Research Lab at 3M as a Senior Research Engineer working on a broad range of projects related to inorganic materials, developing materials solutions for industries including electronic devices, aerospace components, energy devices, and nuclear power generation, among others.

# Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, University of Illinois at Urbana-Champaign, 2020

Bachelors, Materials Science and Engineering, University of Minnesota, 2014

### **Prior Experience**

Senior Research Engineer, 3M, 2020-2025

#### **Professional Affiliations**

American Ceramic Society (ACerS)

## **Publications**

Lang E, Taylor C, Madden N, Marchhart T, Smith CS, Wang X, Krogstad JA. Examination of Early-Stage Helium Retention and Release in Dispersion-Strengthened Tungsten Alloys. Fusion Science and Technology (2023). DOI: 10.1080/15361055.2022.21644441

Lang E, Schamis H, Madden N, Smith CS, Kolasinkski R, Krogstad JA, Allain JP. "Recrystallization suppression through dispersion-strengthening of tungsten." J. Nuclear Materials 545 152613 (2021). DOI: 10.1016/j.jnucmat.2020.152613

Shetty P, Zhang R, Haire BT, Smith CS, Kenny LM, Wu T, Subramani V, Morrison J, Quayle P, Yeates S, Braun PV, Krogstad JA. Effect of surface chemistry and roughness on the high temperature deposition of a model asphaltene. ACS Energy & Fuels. 33 [5], 4104-4114 (2019). DOI: 10.1021/acs.energyfuels.9b00386

Lang E, Madden N, Smith CS, Krogstad JA, Allain JP. Deciphering the role of second phase precipitates on early-stage surface morphology development of dispersion-strengthened W alloys under low energy He irradiation. Nucl. Mater. Energy. 19, 47-54 (2019). DOI: 10.1016/j.nme.2019.01.016

Lang E, Madden N, Smith CS, Krogstad JA, Allain JP. Microstructural and compositional effects of transition metal carbide additions on dispersion-strengthened W alloys fabricated via spark plasma sintering. Int J Refract Metals Hard Mater. 75, 279-286 (2018). DOI: 10.1016/j.ijrmhm.2018.04.015

#### **Presentations**

Smith CS, Rizzardi Q, Maass R, Krogstad JA. Evaluating a Critical Resolved Shear Stress Criterion for Domain Nucleation in Ferroelastic Ceramics. Invited, ICACC21, Daytona Beach, FL (2021)

Smith CS, Krogstad JA. Characterizing the Influence of Local Microstructure on Ferroelastic Deformation in Ceramics. ICACC19, Daytona Beach, FL (2019)

Smith CS, Krogstad JA. Multi-length-scale Characterization of Ferroelastic Deformation in Ceramic Materials. ICSMA18, Ohio State University, Columbus, OH (2018)

Smith CS, Madden NJ, Krogstad JA. Quantifying Densification Variability in Ionic Conduction Ceramics via Spark Plasma Sintering. ICACC18, Daytona Beach, FL (2018)

Smith CS, Krogstad JA. Mechanical Behavior of Single Domain Polycrystalline and Single Crystal Ferroelastic Ceramics. ICACC18, Daytona Beach, FL (2018)

#### Peer Reviews

Acta Materialia