

The Department of Mechanical Engineering presents:

The Ph.D. Dissertation Defense of **Stephen A. Exarhos**

**Friday, August 24, 2018,
9AM in Bourns Hall A265**

**Nanoparticle Matter: Synthesis, Characterization, Control, and
Application of YSZ, CZTS, and ZrN**

Doctor of Philosophy, Graduate Program in Mechanical Engineering
University of California, Riverside, August 2018
Dr. Lorenzo Mangolini, Chairperson

As a material is reduced down to sub-100 nm dimensions, its interaction with light, with heat, and with other matter changes due in part to increased confinement of free charges and to an increased surface area relative to volume. In practice, different materials and their characteristics can be tuned to control bulk-system properties like optical transparency, free charge generation, electric field enhancement, and localized thermal enhancement. In this presentation, I will discuss the controlled synthesis and characterization of three different nanoparticle material systems: yttria-stabilized zirconia (YSZ), copper-zinc-tin-sulfide (CZTS), and zirconium nitride (ZrN). I will additionally discuss the viability of using the produced materials in proposed applications, namely: YSZ as the basis material for transparent sintered ceramic disks for use as cranial implants; CZTS as the basis material for earth-abundant, inexpensive, polycrystalline thin film photovoltaics; and ZrN as a visible spectrum plasmonic absorbing material for use in light-induced localized field enhancement applications.

MECHANICAL ENGINEERING
DISSERTATION DEFENSE