

Research Summary for Stefan Zollner

Research Projects: Spectroscopic Ellipsometry for Measurements of Optical Constants

- **Ferromagnetic metals:** How do the optical constants of ferromagnetic metals (such as Ni, Ni-Pt, or Ni-V alloys) depend on temperature? What can we learn about interband optical transitions and free carrier properties? Investigate complete spectral range (0.03 to 6.6 eV).
- **Oxides:** How do the optical constants of thin oxide layers (ZnO, perovskites, etc) change as a function of thickness? Do they depend on the substrate material (Si, quartz)? What can we learn about excitons and lattice vibrations in such confined systems?
- **Semiconductors and topological insulators:** Optical properties, band structure, and lattice vibrations of alpha-tin and germanium-tin alloys. Germanium-on-insulator layers. Temperature dependence of the optical constants of germanium and chalcogenide phase change memory alloys. Anodic oxidation of semiconductors.
- **Femtosecond pump-probe ellipsometry:** Ultrafast processes in semiconductors and complex metal oxides. Relaxation and recombination mechanisms.
- Sabbatical from mid-May 2018 to Mid-August 2019, with extended research visits at Wright-Patterson AFB (AFRL/RV, Dayton, OH), Kirtland AFB (AFRL/RV, Albuquerque, NM), and Prague (Institute of Physics, Czech Academy of Sciences).

Grants:

- NSF, *Vibrational and electronic properties of complex metal oxides by spectroscopic ellipsometry*, DMR Ceramics Program, 8/15/15 to 7/31/19, USD 400,000.

Students:

- Farzin Abadizaman, Nuwanjula Samarasingha, Rigo Carrasco, Carola Emminger (Ph.D.)
- Pablo Paradis, Cesy Zamarripa, Zachary Yoder (undergraduates)
- Undergraduate students regularly contribute in laboratory experiments, data analysis, and attend regional and national society meetings to present posters and conference talks.

Significant collaborations:

- Indian Institute of Technology, Indore: ZnO thin films (Sudeshna Chattopadhyay)
- Sandia National Lab: Chalcogenide phase change memory alloy deposition (David Adams)
- Air Force Research Lab, Sensors Directorate, Dayton, OH: Alpha-tin synthesis (Arnold Kiefer)

Honors, Awards, Publications:

- Fellow of the American Vacuum Society (AVS), November 2017.
- Three recent (2018/19) articles published in APL, two in J. Vac. Sci. & Techn. B.
- 45 recent (2018/19) conference contributions (mostly students and collaborators).