

Title: Fundamental Studies of Nano-Structured Oxides for Energy Applications

Type: Student

Awardee: Dmitry Kukuruznyak

Mentors: Fumio Ohuchi– UW; Rajendra Bordia – UW; Peter Martin - PNNL

Description: A new and exciting class of oxide materials has recently been discovered that have unusual electrical and thermal properties. These materials have a high electrical conductivity (σ) and low thermal conductivity (κ). In general, materials do not have this combination of properties due to the constraints imposed by the Wiederman-Franz law. However, in these materials, the electrical conduction is by “polaron hopping” and this gives rise to such unusual combinations of properties. As a result of high σ and low κ and a large value of the Seebeck coefficient, one potentially exciting applications of these materials is in thermoelectric energy conversion. Because these materials are stable at high temperatures, they are candidates for devices for waste heat recovery. In order to realize this potential and other applications, a fundamental understanding of the electronic structure, transport mechanism and the effect of nanostructure of their properties is needed. This is the goal of this research proposal.