

Vivian Tran

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Postdoctoral Fellows: Qiyang Lu and Nikolai Tsvetkov

Faculty Supervisor: Bilge Yildiz

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### **Elastic Strain in Oxides**

Elastic strain engineering has the potential to enable high performance catalysts and pave the way for efficient electrochemical energy conversion devices. Through applying mechanical stress on materials, thereby “stretching” them, it is possible to activate chemical reactions by altering the inherent energy landscape. Much research has gone into investigating strained metal surfaces, showing that the stress largely enhances their surface reactivity and d-band electron energies (which affects their adsorption strengths and dissociation energy barriers). This motivates the investigation of the effects of elastic strain in oxides, which has not been largely explored yet. For oxides, mechanical stress alters such properties as the oxygen defect formation enthalpy, migration energy barrier, adsorption energy, dissociation barrier, and charge transfer barrier. Currently, the prospect of using elastic strain in oxides to tune reaction and diffusion kinetics in functional oxides for catalytic and energy applications has been largely unexplored. However, it has great potential that should be further investigated, and that is what the Yildiz group is doing.

For this project, I will be working specifically with solid oxide fuel cells. I will be contributing to the electrochemical and electrical characterizations of the various cathodes made by the group, helping the group measure and analyze more materials. To do this, I will be helping out with experiments involving the use of scanning tunneling microscopy and spectroscopy to determine the surface atomic and electronic structure of the materials.

The research facility for this project is on-campus, in Building NW-13, at 138 Albany St. Tentatively, I am currently planning to devote about 8 hours a week to this research project. Because the experiments will take a few hour’s time, I am planning to split up my committed time to this project into two or three chunks each week. I am planning to go into lab once each weekend, every Friday, and possibly either Monday or Wednesday afternoon as well.

I am excited about this research project because it will give me the opportunity to gain a lot of depth in something I find both relevant and interesting. I think it will be a great starting point from which to gain exposure to the field of nuclear science and engineering. I am also looking forward to learning new experimental techniques and research skills. Overall, this project will give me an opportunity to gain experience in performing research and experiments, which will give me a better sense of where I want to go with my major and career.