Yildiz wins 2012 Charles W. Tobias Young Investigator Award

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Bilge Yildiz, associate professor of nuclear science and engineering, is the winner of the 2012 Charles W. Tobias Young Investigator Award. Established in 2003 by the Electrochemical Society (ECS) [1], the biennial Tobias Award recognizes outstanding scientific or engineering work in fundamental or applied electrochemistry or solid-state science and technology by a young scientist or engineer.

The award ceremony will take place in Hawaii in October 2012 at the joint international meeting of the Electrochemical Society and the Electrochemical Society of Japan, where Yildiz will present a keynote lecture.

The focus of Yildiz's research is understanding the response of the surface physical chemistry of ionic solids when driven by dynamic environments of chemical reactivity and mechanical stress. Her goal is to advance quantitative understanding of how surface activity and charge transport kinetics are driven by the environment, and to apply this knowledge to enable the design of novel surface chemistries for highly efficient solid oxide fuel/electrolysis cells and for corrosion-resistant materials.

Yildiz's research builds equally on experimental and computational techniques at comparable length and time scales. She and her group have developed a unique capability to probe the surface chemical and electronic state with high spatial resolution in situ at elevated temperatures, in reactive gas conditions, and with induced stresses, using scanning tunneling microscopy and spectroscopy (STM/STS). Her research has demonstrated and explained how elevated temperatures and material strain state alter the surface cation chemistry and electronic structure on transition metal oxide surfaces. These results are important for describing and tuning the surface activity to oxygen reduction and water-splitting reactions. Her group has elucidated quantitatively the mechanisms by which the lattice strain facilitates oxygen ion diffusion in fluorite and perovskite oxides, and favors oxygen chemisorption and vacancy formation on perovskites. These findings are important for accelerating oxygen transport and oxygen reduction kinetics on novel electrolyte and cathode structures made of ionic materials.

In recent work, the Yildiz group has described how individual crystal dislocations perturb the surface electronic structure to increase reactivity in oxidative corrosion. These studies capture computationally the evolution of defect structures at the atomic level over experimental time scales, an important new capability to predict the aging of material microstructure both in high temperature fuel cells and in corrosion.

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[1] http://www.electrochem.org/