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Special Seminar (Online)
Department of Chemistry, METU

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Molecular Views of Charged Aqueous Interfaces: From Environmental Geochemistry to Electrochemical Water Oxidation to Ocean Wave Energy Harvesting

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2001-	Professor of Chemistry at Northwestern University Senior Editor, J Phys Chem, ACS
1998-01	Postdoc, NOAA Fellow with Mario Molina (1995 Nobel Prize in Chemistry) at MIT
1998	PhD, Chemistry, Georgetown University
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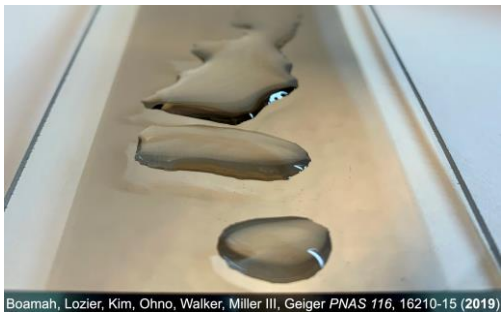
Abstract: Fundamental investigations of aqueous:solid interfaces and their applications for geochemical pollutant transport, the oxygen evolution reaction (OER), and ocean wave energy harvesting are presented. First, nonlinear optical laser spectroscopy reveals the number of specifically adsorbed inorganic and organic ions and the net-aligned interfacial water molecules and the energetics associated with flipping them as a function of experimental conditions (pH, ionic strength, applied bias). A spectroscopic nonlinear optical autocorrelator approach yields strong signals at wavelengths consistent with high-oxidation states oxo species that are invisible in cyclic voltammetry. Implications for strategies to lower the OER's overpotential are discussed. Second, metal nanolayers are subjected to wave action within a wave tank containing ocean water simulant. Electrical measurements using external resistors yield power curves that exceed 50 microwatts per wave event when a nanolayer deposited on a glass microscope slide is paired with a sacrificial anode. Voltages and currents are large enough to light up a blue light emitting diode with each wave event. The linear dependence of output power and wave height velocity is demonstrated. Implications for sustainable energy harvesting are discussed.



Franz Geiger is currently the Charles E. and Emma H. Morrison Professor of Chemistry at Northwestern University. He is a Fellow of the Alfred P. Sloan Foundation, the American Association for the Advancement of Science (AAAS), and the Royal Society of Chemistry (RSC). He is the recipient of the 2021 ACS Nobel laureate Signature Award, the 2017 Friedrich Wilhelm Bessel Prize of the Alexander von Humboldt (AvH) Foundation, and the 2016 Faculty Diversity Award from Northwestern University's Graduate School. He serves as Senior Editor at the Journal of Physical Chemistry of the American Chemical Society (ACS) and starts as new Executive Editor in 2025. He also served as chair of the Experimental Physical Chemistry (EXP) subdivision of the ACS Physical Chemistry Division, on the Science Board of the Telluride Science & Innovation Center (formerly TSRC), on the International Advisory Board of the Pacific Conference on Spectroscopy and Dynamics, (PCSD), and on the Chemical Sciences Roundtable of the National Academy of Sciences (NAS).

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