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Mechanical Engineering Seminar Series

Ocean Carbon Dioxide Removal via Electrochemical Ocean Alkalinity Enhancement

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Yale University

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ME Seminar Zoom link

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Abstract
The 2022 report, Mitigation of Climate Change, released by the Intergovernmental Panel on Climate Change (IPCC) suggests that we will need to remove 5.5 gigatons of carbon dioxide (CO_2) from the atmosphere by 2100 to limit global warming to 1.5°C. The ocean is a promising reservoir for carbon dioxide removal (CDR) as it contains approximately 45 times more carbon than the atmosphere and acts as a natural control for atmospheric CO_2 levels. The National Academies of Sciences, Engineering, and Medicine report, A Research Strategy for Ocean-based Carbon Dioxide Removal, recently recommended a $125 million research program to better understand overarching challenges for all ocean CDR approaches. Ocean alkalinity enhancement (OAE) is a specific ocean CDR approach that can locally reverse ocean acidification and draw additional CO_2 from the air into oceanic bicarbonate where it is stored for over 10,000 years, mimicking the Earth's natural mechanism for regulating the atmospheric CO_2 concentration. In this talk, I will review the latest results from my group on electrochemical ocean alkalinity enhancement and describe the efforts to commercialize this technology at Ebb Carbon, Inc.. Finally, I will highlight research challenges and opportunities to which the scientific community could lend their expertise.

Bio
Matthew Eisaman is an Associate Professor in the Department of Earth & Planetary Sciences and the Yale Center for Natural Carbon Capture (YCNCC) at Yale University. Prior to Yale, he served as an Associate Professor at Stony Brook University. In 2021, Matt co-founded Ebb Carbon, a startup based in San Carlos, CA that is commercializing ocean-based carbon dioxide removal. He currently advises Ebb Carbon as Chief Scientist. Prior to Stony Brook, Prof. Eisaman was a Physicist at Brookhaven National Lab from 2011-2014, an Applied Physicist in the Cleantech Innovation Program at Xerox PARC in Palo Alto, CA from 2008-2011, and an NRC Postdoc at NIST from 2006-2008. He received his Ph.D. in Physics from Harvard and A.B. in Physics from Princeton in 2006 and 2000, respectively. Prof. Eisaman's research is focused on ocean carbon dioxide removal, including: minimizing its energy use and environmental impact; quantifying its effects on marine ecosystems; establishing and improving methods for measurement, reporting, and verification; and exploring the potential for colocation with other carbon removal approaches.

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