Environmental Engineering Seminar

The Astani Department of Civil & Environmental Engineering presents

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Date: Thursday, December 2, 2021
Time: 11am-12pm
Place: MCB 101

Zoom Meeting
https://usc.zoom.us/j/99680049945
Meeting ID: 996 8004 9945

Sustainable membrane-based carbon mineralization

Abstract:
Nearly 65% of fly ash from coal-fired power plants is landfilled, and carbon capture by amine-based solvents reduces harmful emissions. However, strategies are limited for sustainably utilizing this fly ash and captured carbon. Here, membrane crystallization facilitates direct carbonate mineralization from carbon-loaded amines when combined with alkaline fly ash metals. Mineral growth is conducted on polyvinylidene fluoride (PVDF) and polytetrafluoroethylene (PTFE) membranes using 50 and 40 °C solutions of 30 wt% monoethanolamine (MEA) loaded with 14-15% CO_2 and representative Ca^{2+} concentrations from fly ash (3.15 M) as well as sea water brine (0.18 M). The lower surface energy of the PTFE membrane is found to more rapidly promote mineralization due to 20% greater vapor transfer rate. Mineral identity and growth characteristics are presented, and analysis is extended to explore the limitations and improvements of this strategy as well as the feasibility of future implementation.

Bio:
Christie earned his doctorate in environmental engineering from Vanderbilt University in May 2020, where he worked to advance membrane distillation by investigating the causes and effects of inorganic fouling on membrane surfaces and the thermodynamic implications of polarization phenomena. His work led to the co-founding of an industrial wastewater treatment company, C-Salt. Christie later joined the Andlinger Center at Princeton University as a recipient of the Presidential Postdoctoral Fellowship. With advisors Prof. Z. Jason Ren and Prof. Rodney Priestley, he explores the intersection of membrane separation and crystal nucleation to sustainably recover resources from wastewater streams associated with hydrocarbon combustion.

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