ANSELL LECTURE SEMINAR SERIES

Confronting Corrosion Challenges in the Oil & Gas Industry and Carbon Capture & Storage (CCS) Processes

THURSDAY October 24th | 4 P.M. | Hill Hall 202

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Yoon-Seok Choi has been a research associate professor in the Department of Chemical and Biomolecular Engineering and the associate director for research at the Institute for Corrosion and Multiphase Technology (ICMT) at Ohio University since 2010. He earned his B.S. in Metallurgical Engineering, as well as his M.S. and Ph.D. in Advanced Materials Engineering from Sungkyunkwan University in South Korea. After completing his doctorate, he worked as a postdoctoral researcher at the University of South Carolina from 2005-2007 and at Ohio University from 2007-2010. His research focuses on evaluating the corrosion properties of materials and developing corrosion prediction models under various environments, including oil and gas production/transportation and Carbon Capture and Storage (CCS) process. He has published over 50 peer-reviewed papers in reputable international journals related to corrosion and electrochemistry.

Gaseous CO_2 is stable, mostly inert and non-corrosive. However, upon dissolution in water and a subsequent hydration, a more reactive chemical species - carbonic acid, is formed, which then partially dissociates to form an acidic solution, corrosive for carbon steel. Due to partial dissociation, these kinds of aqueous solutions are called weak acids, even if there is nothing weak about them when it comes to corrosion. Actually, aqueous CO_2 solutions are more corrosive than strong acid solutions at the same pH. A lot is known about corrosion of carbon steel in aqueous CO_2 solutions: the water speciation, the electrochemistry of cathodic and anodic reactions, the formation of protective layers, the most influential factors, etc. Over the past 50 years a vast body of knowledge was generated in this field, mostly driven by the challenges coming from the oil and gas industry, where the hydrocarbons that emerge from the ground are always accompanied with some CO_2 and water, making internal corrosion of carbon steel facilities a large problem. Wells, pipelines, processing and distribution facilities are all affected.

Removal of anthropogenic CO_2 from the atmosphere and its capture at the source are some of the largest scientific and engineering challenges facing humanity in the 21st century. If this CO_2 is to be safely captured, transported and stored underground, it must be compressed to pressures where it can be in liquid or supercritical form. Even very small amounts of water, SO_x and NO_x (in the ppm range) can lead to catastrophically high internal corrosion rates of transportation and injection facilities made from carbon steel. Little is known about this type of corrosion and the understanding we have about aqueous CO_2 corrosion of carbon steel in the oil and gas industry does not carry over entirely.

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