Amgen Seminar Series in Chemical Engineering
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Permanent Carbon Capture and Storage in Geologic Reservoirs via Mineral Carbonation

By

Professor Juerg Matter
LDEO - Geochemistry
Columbia University

The storage of large volumes of carbon dioxide (CO_2) in deep geological formations is one of the most promising climate mitigation options. The long-term retention time and environmental safety of CO_2 storage are defined by the interaction of the injected CO_2 with formation fluids and rocks. Finding storage solutions that are permanent, thermodynamically stable and environmentally benign would be desirable. Today, underground storage of CO_2 is being conducted in depleted oil and gas reservoirs or in deep saline aquifers. To meet the potentially dramatic increase in demand for storage of CO_2, unconventional formations and storage concepts must be explored.
Storage in unconventional formations includes injection of CO_2 into formations with particularly favorable containment properties. When injected into basalt or mantle peridotite, CO_2 is expected to react with the calcium, magnesium silicate minerals of these rocks to form carbonate precipitate, permanently fixing the CO_2 at depth.

This talk aims to provide an overview of unconventional CO_2 capture and storage techniques in geologic reservoirs with focus on on-going pilot CO_2 injection and storage studies in Iceland and the Sultanate of Oman. In the CarbFix pilot project in Iceland, we developed a storage approach that accelerates the mineral carbonation in basaltic rocks. Approximately 2,200 tons of CO_2 from a geothermal power plant are injected fully dissolved in water into a permeable basalt formation in SW Iceland for the purpose of permanent storage. In the Sultanate of Oman, we study the natural carbonation of mantle peridotites as an analog for mineral carbonation, and evaluate the feasibility of engineering such a system.

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