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## Evidence of self-sealing in wellbore cement under geologic CO<sub>2</sub> storage conditions by micro-CT, SEM and Raman observations

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In this study, reaction experiments between CO<sub>2</sub>-saturated brine and wellbore cement samples cured under different pressures were conducted to study microstructural and mineral composition changes using micro-computed tomography (micro-CT), scanning electron microscopy (SEM) and Raman spectroscopy. The CT images of post-CO<sub>2</sub> exposure cement samples showed a dissolution-precipitation-dissolution pattern at the exterior of the samples. The dissolution in the inner hole of the samples, however, was not significant. Instead, only CaCO<sub>3</sub> precipitation was observed in the inner hole. CaCO<sub>3</sub> precipitation in the inner hole contributes to selfsealing of the cement, which reduces the risk of CO<sub>2</sub> leakage through wellbore cement. According to CT and SEM observations, a higher curing pressure caused more precipitation of CaCO<sub>3</sub>, which favored cement selfsealing when exposed to CO<sub>2</sub>. The appearance of a C—O peak and the disappearance of a —OH peak after reaction with CO<sub>2</sub> were observed by Raman spectroscopy, which was attributed to cement carbonation that converted Ca(OH)<sub>2</sub> into CaCO<sub>3</sub>. This study provides solid evidence of cement self-sealing due to cement carbonation under geologic CO<sub>2</sub> storage circumstances.

### Participation

In-Person

### References

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### Energy Transition Focused Abstracts

**Primary authors:** Ms WANG, Yan; Prof. ZHANG, Liwei (Institute of Rock and Soil Mechanics, Chinese Academy of Sciences); GAN, Manguang

**Presenter:** Ms WANG, Yan

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