Development and testing of novel cement designs for enhanced CCS well integrity

Publieke samenvatting / Public summary

Aanleiding

The leakage of CO2 through or along wellbores has been identified as one of the main challenges to secure subsurface CO2-storage. Currently used wellbore sealants, commonly based on Ordinary Portland Cement (OPC), can be a large vulnerability during CO2-injection and -storage. Leakages may form through the cement, or along the cement-steel or cement-rock interfaces, as the result of chemical, thermal, or mechanical effects. Therefore, better sealants are needed, that can prevent leakages from forming, and that preferably demonstrate self-healing capabilities when leakage pathways do form. In order to successfully develop such materials, critical properties need to be identified that will ensure seal integrity, and practical methods and procedures for measuring these properties under in-situ conditions need to be developed, along with models for their extrapolation.

Doelstelling

CEMENTEGRITY will address the chemical, thermal and mechanical mechanisms that may damage wellbore integrity during CO2-injection and -storage, through experimental research on five different sealant compositions, that vary from OPC-based compositions representative of currently used sealants, to newly developed, rock-based geopolymers. The experimental work will be supported by numerical modelling.

Korte omschrijving

WP1 will perform flow-through experiments with

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Algemene informatie / General information

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sub-supercritical CO2, and CO2 bearing H2S in an aqueous environment, to test changes in permeability and mechanical properties resulting from leaching and precipitation. WP2 will expose sealants to supercritical CO2 containing H2S as well as other common impurities, to investigate changes in mineral composition. WP3 will expose sealant specimens to thermal shocks and cycling, to observe thermally-induced cracking and the formation of leakage pathway along the annular contacts between sealant and wellbore. WP4 will develop numerical models to extrapolate experimental results, focusing particularly on geopolymer systems. WP5 will measure sealant-steel bond strengths and develop electrical resistivity methods for in-situ monitoring of sealant and interface integrities. WP6 will develop a novel, rock-based geopolymer sealant specifically for CCS applications.

Resultaat

Based on these WPs, WP7 will identify key properties to ensure long-term integrity of wellbore seals during CCS, as well as suitable methods for measuring these properties. These methods can then be applied when developing new sealants for CCS, to ensure the long-term integrity of these sealants when used during CCS.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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