Porosity and Permeability of Class G Cement in pre- and post CO_2 injection

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Abstract

Identification and mitigation of CO_2 leakage through well cement, particularly for abandoned wells, is currently considered one of the major technical challenges associated with ensuring security of CO_2 storage. Any potential leakage pathways in a typical abandoned well would likely be along the well cement, and would arise due to the interactions between CO_2, brine and the well cement that affect mineral stability and lead to carbonation [1-3]. Any resultant degradation, together with a general increase of porosity and permeability, could lead to the loss of cement structural integrity. Accordingly, a new experimental procedure has been used here to improve our understanding of reactivity of CO_2-brine-well cement systems. For the experimental tests, API Class G cement samples were prepared by following the same industrial cementing process conditions used in the depleted Goldeneye gas condensate reservoir (North Sea). The analysis further shows variations of the primary porosity with confining pressure in which has been subjected, together with a slight increase of permeability with depth. This phenomenon is mainly caused by the presence of microcracks. The results obtained once the cement samples have been chemically reacted suggest that there is a decrease of bulk porosity caused by the precipitation of carbonates into the pore space while permeability has experienced a noticeable increase.

References

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