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STUDIES ON DUCTILE - BRITTLE TRANSITION FOR CARBON DIOXIDE PIPELINES

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Abstract

In order to diminish the climate changes due to greenhouse gases, the capture from the source, transport and storage of carbon dioxide is one of the environmental priorities of the EU until 2050. Transportation of this gas through pipelines (one of the solutions with most advantages in transport) can be done at ambient temperature only at high pressures, so the carbon dioxide to remain in the supercritical state. In case of underground pipelines, there is a risk of cracking at the wall of the pipe, with the release into the atmosphere of a large quantity of gas. The authors demonstrate the existence of a threshold at which the properties of the material change from ductile to brittle properties due to depressurization of the pipe, which has the effect of a rapid drop of the temperature in the crack. This paper presents the factors influencing the ductile-brittle transformation and the factors influencing this transition. Changing to brittle properties into the material of the pipe, leads to a rapid increase of the hole through which the CO₂ leaks. As these pipes are part of a vast network, the amount of carbon dioxide released into the atmosphere can be considerable, affecting the neighboring ecosystem, contributing to the local change of temperature regime and to global warming, by the high concentration of CO₂ in a large area.

Key words: CO₂ pipeline, crack, critical energy, critical stress intensity factor, dynamic tenacity

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