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CO₂ fracturing using the phase field approach for the brittle fracture

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To simulate CO₂ fracturing under an isothermal condition, we propose a phase field model. We take advantage of the ability of the phase field approach to predict fracture initiation and branching, as well as to avoid tracking the fracture path. We model the CO₂ as a compressible fluid by modifying Darcy's law. In particular, we assume that the permeability is correlated to the value of the phase field by the exponential function. The dependence of the CO₂ density as a function of the pressure is captured by the Span-Wagner state equation. The computed pressure breakdown values show good agreement with analytical solutions and experimental results.