

Dissolution in porous media and fractures: initial vs moving front instability

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A reactive fluid flowing through porous or fractured rock and dissolving the rock matrix will trigger an instability, leading to spontaneous formation of pronounced channels or wormholes. We present a linear-stability analysis of this system and show that there are two different instabilities. One is associated with an initial, uniform porosity state whereas the other describes a steadily propagating one-dimensional dissolution front. We discuss the origin of both instabilities and the physical conditions under which they can be observed. In particular, it is argued that the “initial state” instability is relevant to the dissolution of fracture in carbonate rocks, giving rise to the formation of limestone caves.