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# Analytical Model of Porosity–Permeability for porous and fractured media: An application to mineral dissolution and precipitation effects on permeability

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Extensive literature reports modifications to the classic Kozeny–Carman (KC) equation to improve the characterization and simulation of physically heterogeneous systems. These efforts aim at predicting the relationship between matrix porosity and permeability for diverse industrial and geological applications. However, many KC modifications use parameters that are not readily measurable, empirical constants that may reduce their general applicability, or non-empirical fractal approaches that may not be pertinent for rock systems. We have derived a new KC-type analytical solution for predicting rock matrix and fracture permeability during single-phase flow. Fractal models represent matrix grain size distribution (GSD) and matrix blocks within fractured media. Rocks may be consolidated or unconsolidated. There may be cross-flow between pores. Parameters are not empirically based; permeability depends on geometric factors such as pore connectivity, GSD, pore arrangement, and fracture distribution in relation to pore distribution. In addition, the solution implements kinetic rate laws for mineral dissolution and precipitation. Predictions based on the novel solution correspond well to measured matrix and fracture permeability data from natural sandstone and carbonate rocks.

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