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Poroelasticity of Polycrystalline Composites and its Relationship to Biopolymer Induced Pore-Clogging Effects for Improving Water-Flood Efficiency

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One well-documented process for subsurface profile control to improve underground water-flood efficiency involves injecting biopolymer in order to clog pores and selectively reduce in situ fluid permeability. The injected biopolymer is a soft spongy material that attaches to the pore walls, thus reducing the fluid-flow permeability, but without increasing the acoustic wave speed of these granular media. This same process also affects the poroelastic behavior of these porous systems as they are being clogged with the polymers. Effective wave speeds may change simultaneously, but usually by only small amounts. Attenuation can be more strongly affected because of the reduction in fluid permeability. Several of the granular systems used in such studies have involved solid grains having orthorhombic elastic symmetry, being one of the more general symmetries commonly treated for both elastic and poroelastic granular systems. The present work has concentrated on a subset of such orthorhombics when choosing examples to study, including grains of sulfur and uranium.

Keywords: Poroelasticity, Polycrystals, Biot theory, Orthorhombic symmetry