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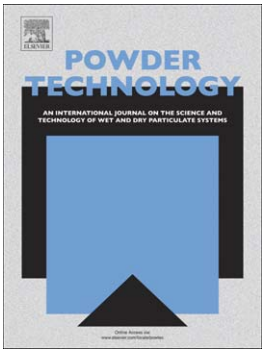

Structural evidence for the timescale separated liquid imbibition phenomenon in porous media

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Structural evidence for the timescale separated liquid imbibition phenomenon in porous media

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Abstract:

When observing supersource wetting during liquid imbibition into complex fine porous media, it is noted that the experimental imbibition rate at the initial stage after liquid contact is frequently greater than that of the subsequent longer term imbibition. This is in contradiction with classical imbibition theory assuming a single equivalent smooth wall horizontal capillary of known radius and given liquid-solid contact angle (Young-Laplace equilibrium). The essentially two timescale behaviour was highlighted in earlier work by the same authors using a paper coating formulation consisting of ground calcium carbonate pigment particles with increasing amount of styrene acrylic binder. The internal surface structure of pores was assumed to generate a pore wall rugosity impacting, in turn, on the length of the liquid-solid wetting contact line. In this paper, we set out to parameterise the internal structure of the pores by nitrogen sorption, and so provide a direct analytical correlation with the observed imbibition rate change between the short timescale and the longer timescale absorption. The effect of internal roughness can be captured in respect to apparent liquid-solid contact angle. The result for a given internal surface roughness is equivalent between the two approaches, in that the contact line length extension as a function

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