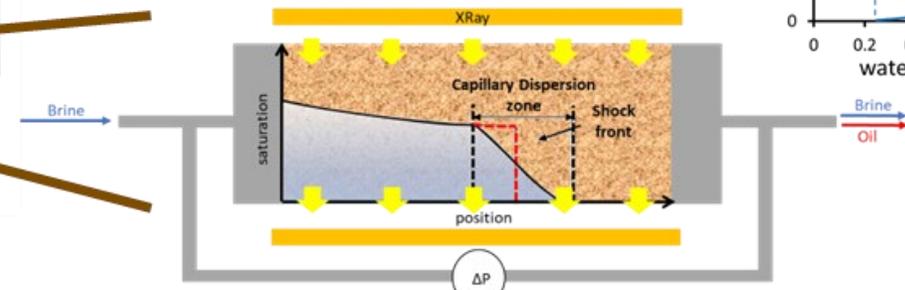
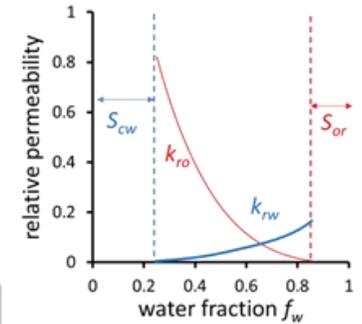


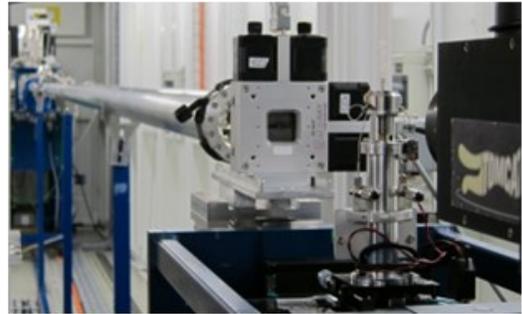
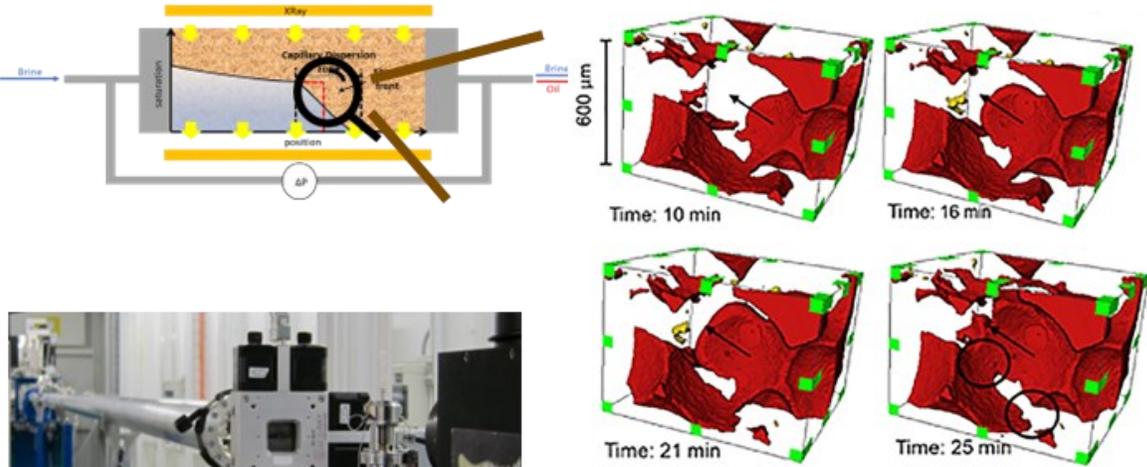
Permeability & Relative permeability

$$q_i = \frac{k_{ri} K}{\mu_i} \left(\frac{dP_i}{dx} - \rho_i g \right),$$



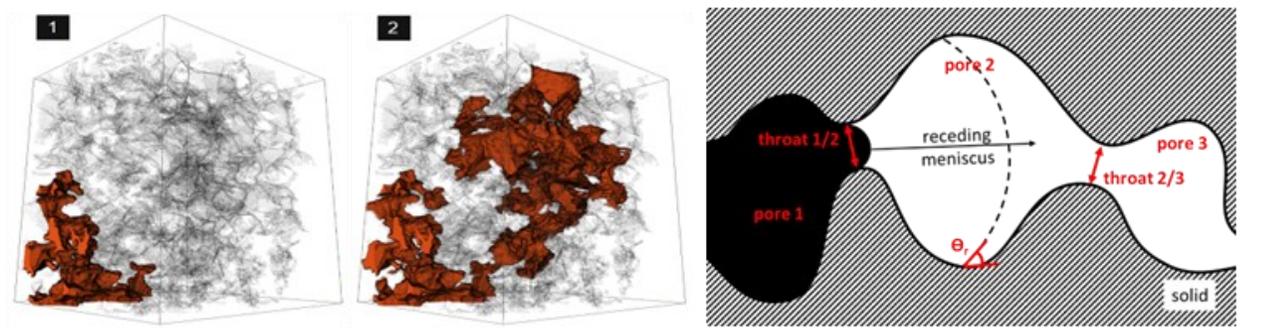
(adapted from Lake, 1989)

Buckley-Leverett

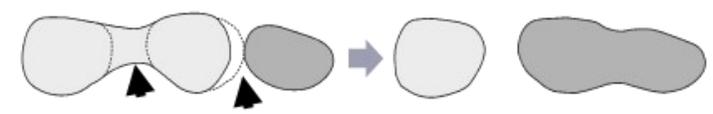


(Ruecker et al., GRL, 2019)

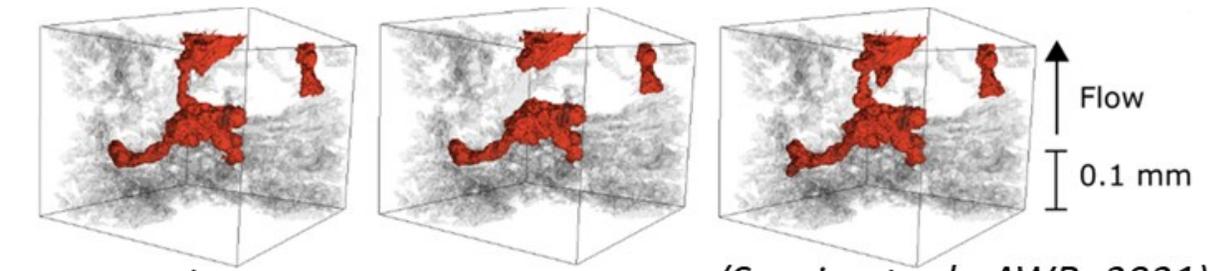
A matter of contact angle?!



(Berg et al., PNAS, 2013)



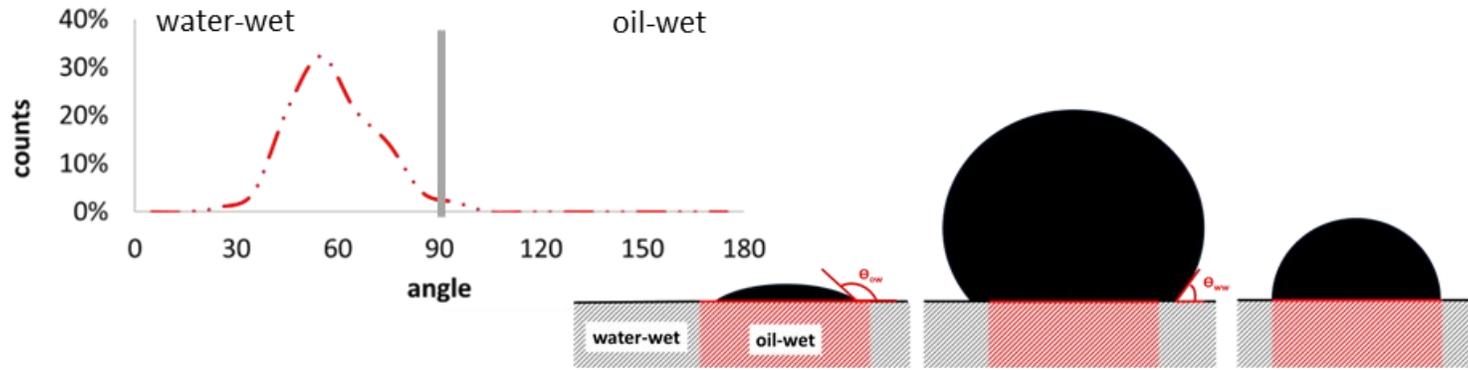
(Ruecker et al., GRL, 2015)



1 image / s

(Spurin et al., AWR, 2021)

What is wrong with the contact angle?



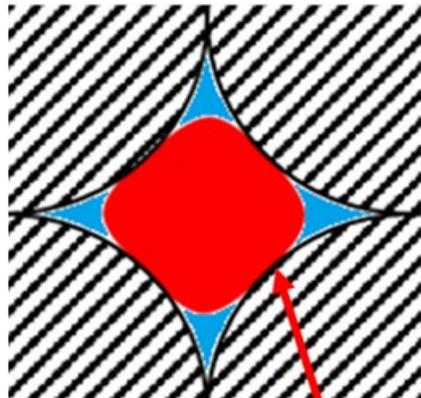
disjoining pressure

$$\Pi(h) = \frac{\delta(\sigma^{ob} + \sigma^{bs})}{\delta h}$$

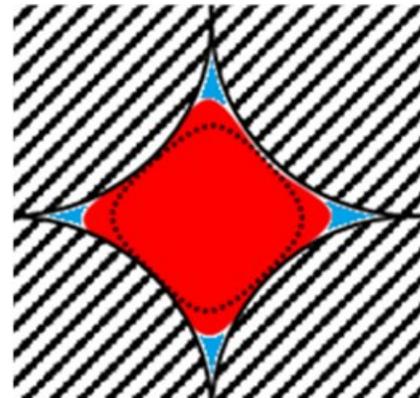
augmented Young Laplace equation

$$P_c^* = \sigma^{ob} \kappa + \Pi(h),$$

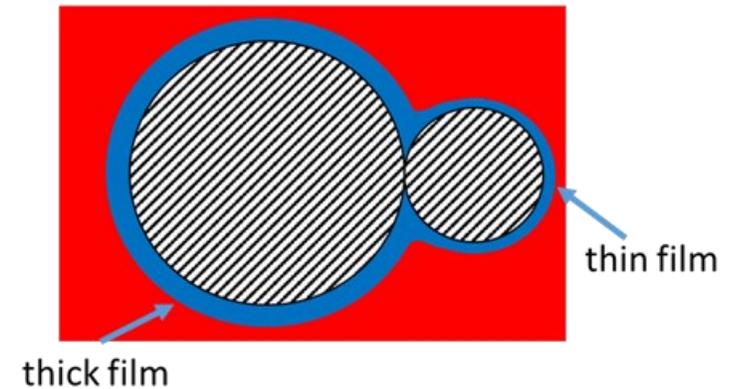
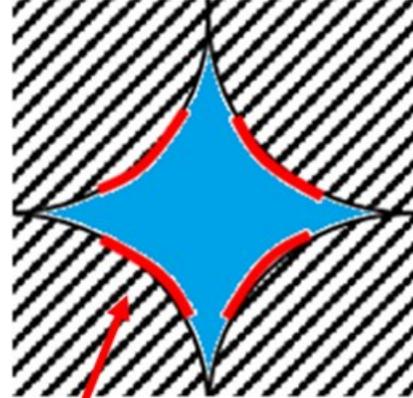
film ruptures if
 $-\sigma^{ob} \kappa > \Pi^{max},$



water film ruptures

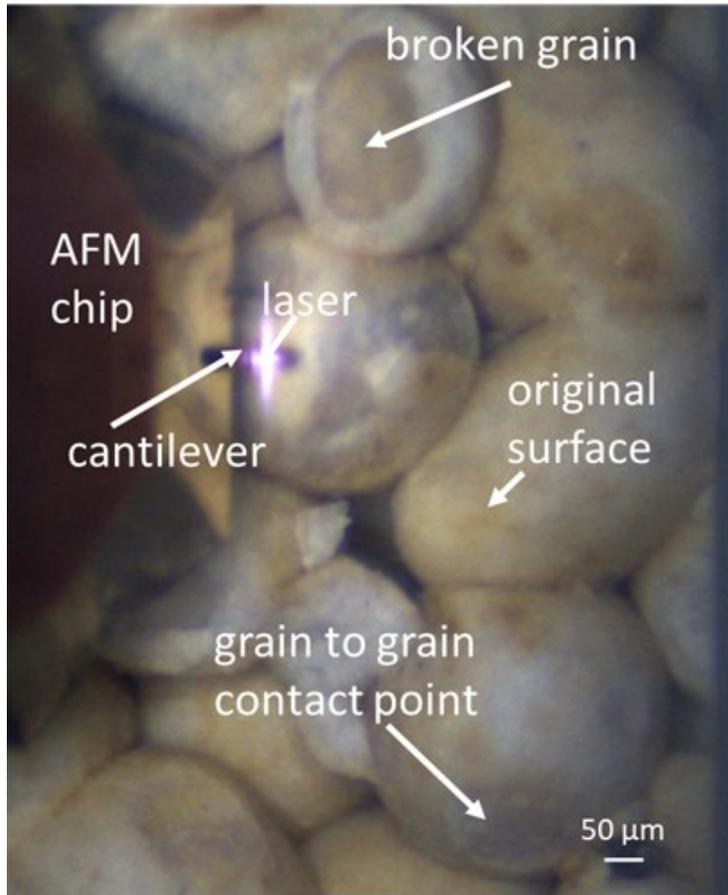


wettability alteration

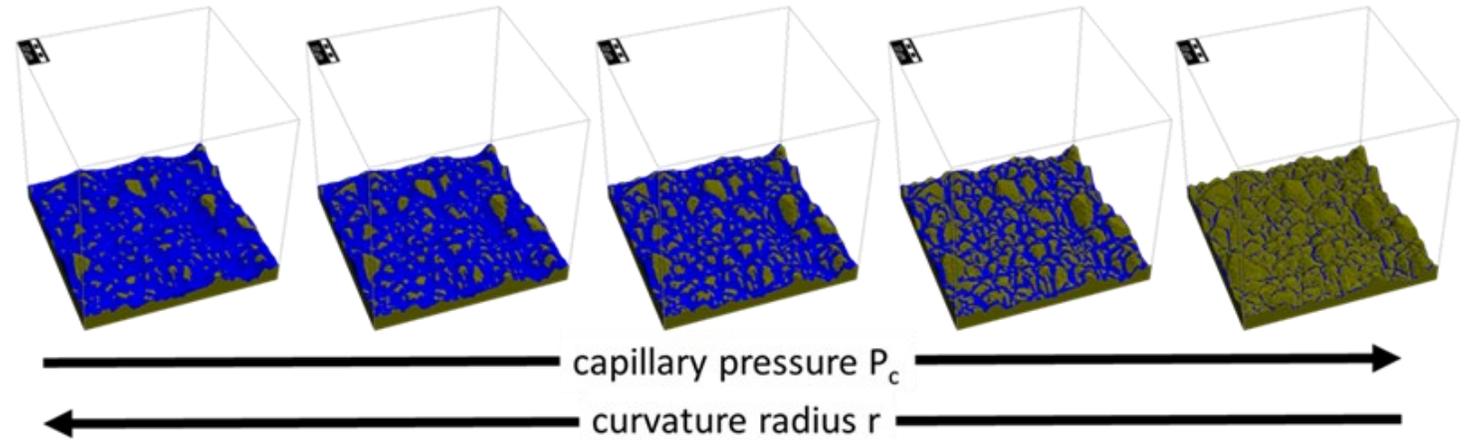


thick film

thin film

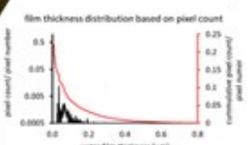
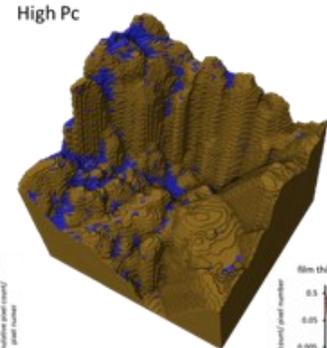
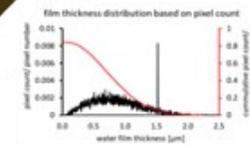
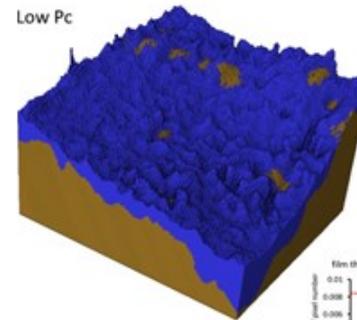
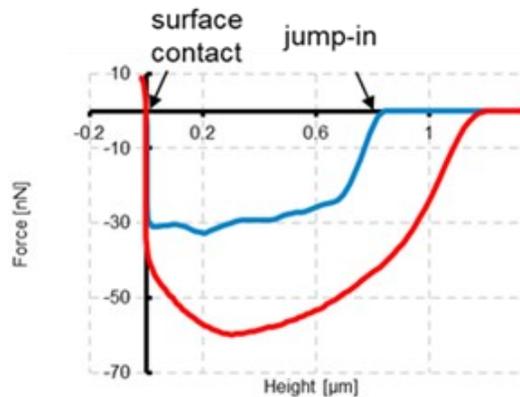


Computational model

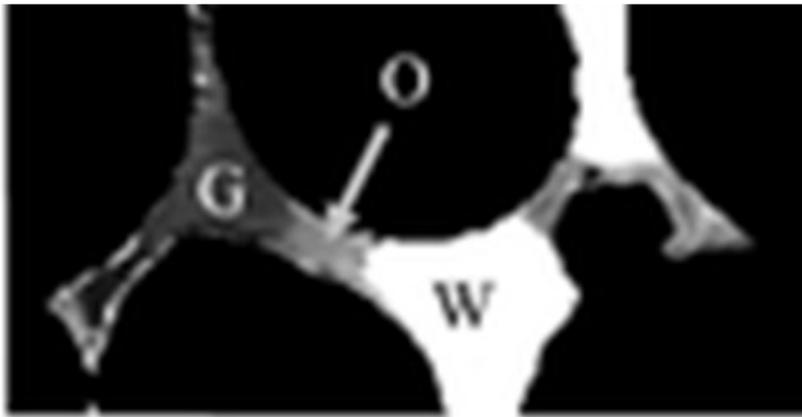


(Ruecker et. al., JCIS, 2020)

Measurement

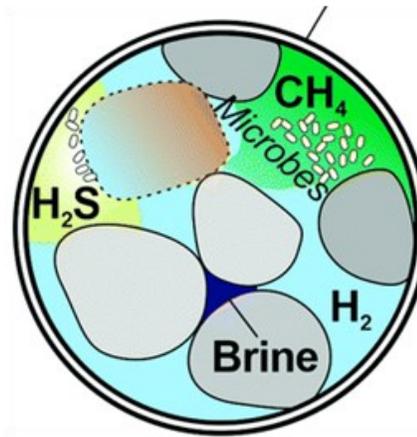


Impact on three-phase flow



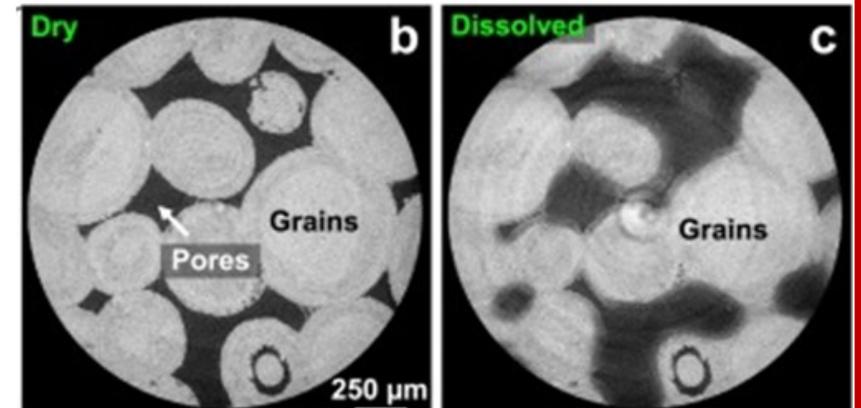
(Scanziani et al, WRR, 2020)

Impact on microbial growth



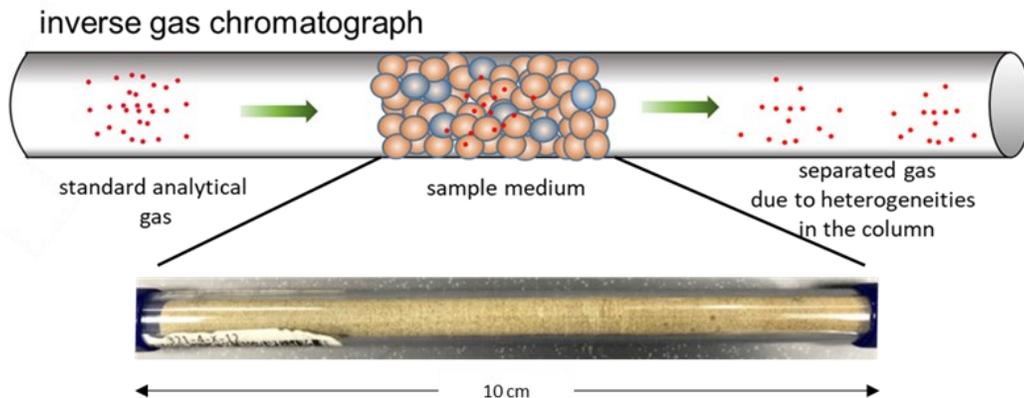
(Heinemann et al, EES, 2021)

Impact on reactive transport

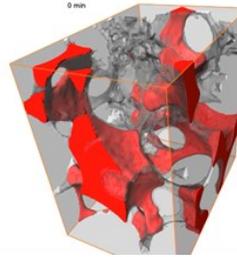


(Singh et al, AWR, 2018)

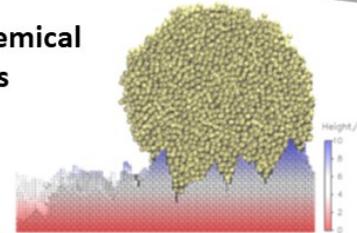
New techniques, to characterize rock structure and chemistry at the accurate length scale



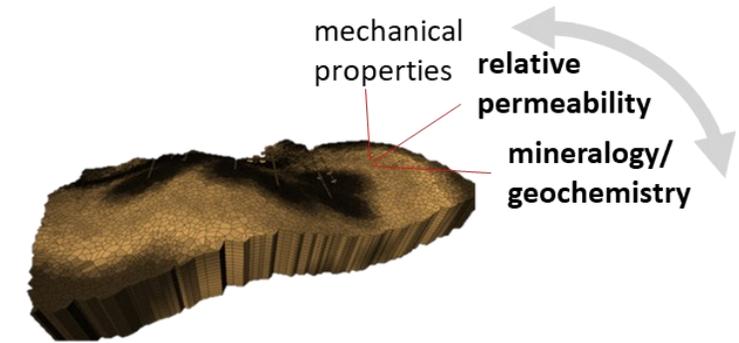
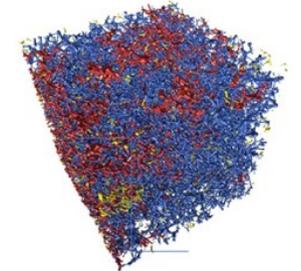
1. Digitizing pore space

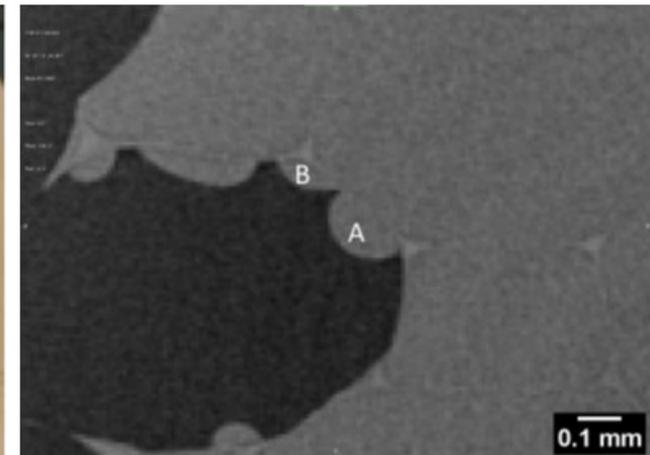
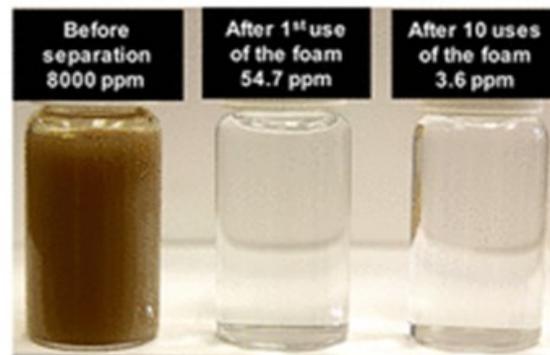
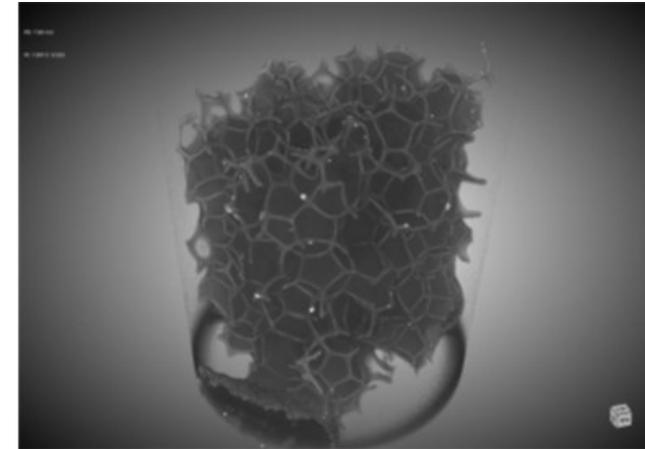
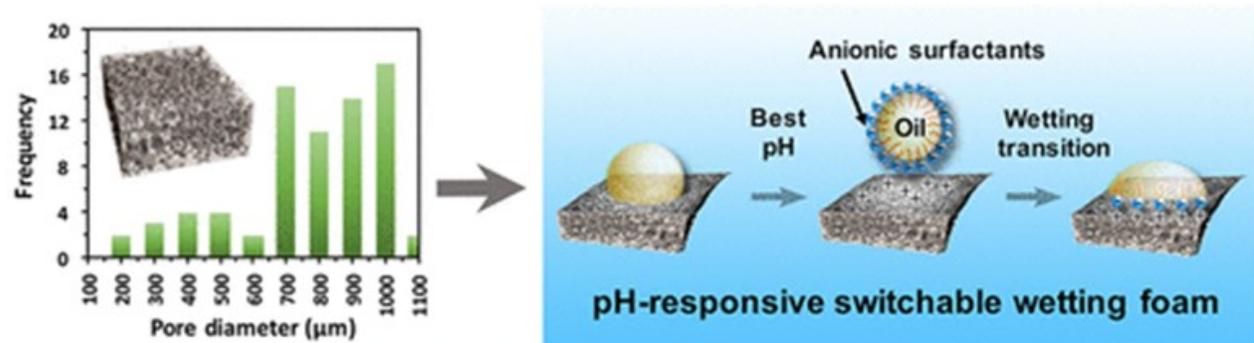


2. Identifying chemical interactions



3. Modelling multiphase flow





(Cherkupally et al, ACS, 2017)

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Funding:



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