**Imaging of in-situ and ex-situ drainage and imbibition experiments**

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We describe several approaches for combining X-ray micro-CT imaging with experiment to better understand drainage and imbibition processes.  In the first approach the experiments are conducted ex-situ, and registration is used to align images taken before and after each experiment to determine pore-scale fluid distributions.  This is particularly useful for the study of centrifuge assisted drainage, where high capillary pressures can be achieved, usually in complex materials where the pore space cannot be fully resolved in the images.  We show that new information about pore-space connectivity and sample wettability can be obtained.   
  
In the second approach we focus on simpler materials where the pore space is almost entirely resolvable and where capillary pressures remain relatively low.  We use both stop-start protocols where the flood is stopped while static images are acquired, and dynamic imaging in which the displacement process is imaged continuously.   This approach is tailored to understanding the pore-scale physics; in particular we investigate the mechanisms behind hysteresis during drainage and imbibition cycles and the role of surface area.