

Digital Rock Properties on Oil Sands

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Oil sands are often comprised of grains immersed in and partially supported by a matrix of heavy oil and/or bitumen. Traditional laboratory measurements of such samples are extremely difficult due to their delicate and friable structure. Ingrain can directly image the 3D pore structure of oil sand on irregularly sized and shaped fragments as they come from a well, sidewall plugs, and core. Computer simulations of traditional laboratory experiments on these digital objects produce the transport, electrical, and elastic properties of oil sands.

By examining these digital objects, we can infer their in-situ state as opposed to the benchtop conditions at which the images are usually obtained (the geometry of the pore space on the benchtop may be altered due to expansion of the pore fluid and handling of the samples). This technology allows Ingrain to infer the absolute and relative permeability as well as electrical, and elastic properties in the reservoir.

Ingrain's image analysis technology allows us to differentiate the grains present in a sample, followed by analyses of grain size distribution and grain shape (sphericity and angularity). These data are essential when planning oil recovery and production; they are also intimately linked to porosity and permeability.

We will present examples of grain size distribution as well as relative permeability curves for different oil sand samples.

If the specific density of the bitumen present in the pores is sufficiently different from those of water and gas, Ingrain's image analysis technology produces the volumetric content of bitumen in a sand sample. This quantity can then be used in reserve estimates and production planning.