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Pore-scale analysis of pyrolyzed oil shale cores

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There are important questions concerning the quality and volume of pore space created during pyrolysis of oil shale to produce shale oil. In this paper, we report on pyrolysis of one-inch diameter cores at different temperatures and heating rates. We report the yield and composition of the oil produced, as measured by chromatography. In addition, we report on detailed 3D imaging of the core before and after pyrolysis to establish the pore structure of cores after reaction using X-ray nano-CT for imaging. The pore structure of the unreacted material was not clear. Selected images of a core pyrolyzed at 400⁰C were obtained at a voxel resolution of about 50 nm. The pore space created during pyrolysis was clearly visible at this resolution and it was possible to distinguish between the pores, the reaction products/residual kerogen, and the host shale rock. The pore structure deduced from the images can be used in Lattice Boltzmann simulations to calculate the permeability of such samples. The permeability of the pyrolyzed sample examined was in the milli-Darcy range, whereas the unreacted core permeability was about three orders of magnitude lower.