The habitat of oil cracking: insights from laboratory pyrolysis experiments.

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Abstract

Experiments were conducted to recognize and possibly distinguish oil cracking in conventional reservoir rock versus source rock. Oil and source rock samples were heated in pressure vessels at 380 °C for 72 hours, which resulted in oil cracking to gas and pyrobitumen, with some residual liquid. The oil samples were heated with different minerals (fine-grained quartz, calcium carbonate, montmorillonite, kaolinite and illite) employing different ratios of the oil to the mineral in each case. Heating oil with quartz or calcium carbonate was used as a proxy for reservoir cracking conditions, while heating oil with clay minerals was used as a proxy for cracking within a source rock. Adjustments in the amount of oil mixed with the mineral and differences in the oil types and source rock types were used to investigate those situations. Based on the experiments, oil cracking in source rock versus reservoir rock can be differentiated by relative concentrations of the prominent C_7 hydrocarbons: methylcyclohexane, methylbenzene (toluene) and n-heptane in the liquid products. Ratios of the prominent C_6 hydrocarbons: cyclohexane, n-hexane and methylcyclopentane did not show a systematic or parallel effect and did not appear to depend systematically on the proxies we tested. Diamondoids as thermal robust nanoparticle could be formed at highly mature and over-mature stages with high catalytic effects of clay minerals. Calcium carbonate inhibits the formation of diamondoids at highly mature and over-mature stages.

Keywords: Oil cracking, Clay minerals, Light hydrocarbons, Produced oil, Nanoparticle, Diamondoids, Pyrobitumen, Pyrolysis.