

## In situ observation of mesophase formation in catalytic hydroconversion of vacuum residue using a stirred hot-stage reactor

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A micro-reactor equipped with a view window and a stirrer was used to observe mesophase formation in Athabasca vacuum residue with and without catalyst. The effect of stirring on mesophase formation and its growth and coalescence was studied during the cracking of vacuum residue under hydrogen at 4.8 MPa and 440°C. Stirring can result in a bimodal distribution of size of mesophase domains. The addition of catalyst likely had both chemical and physical effects on the formation and growth of mesophase. Catalyst gave a delay in the onset of mesophase formation as a chemical effect, and a decrease in the amount of bulk mesophase regions by suppressing the coalescence of smaller mesophase domains as a physical effect. The analysis of the resulting cokes by scanning electron microscopy (SEM) showed that catalyst particles agglomerated and stuck to the outer surface of mesophase domains and suppressed their coalescence. The agglomeration of catalyst particles likely decreased their ability to suppress the formation of small mesophase domains, in the range of a few microns in size. However, catalyst was effective in suppressing the formation of bulk mesophase domains with areas over 2000  $\mu\text{m}^2$ .

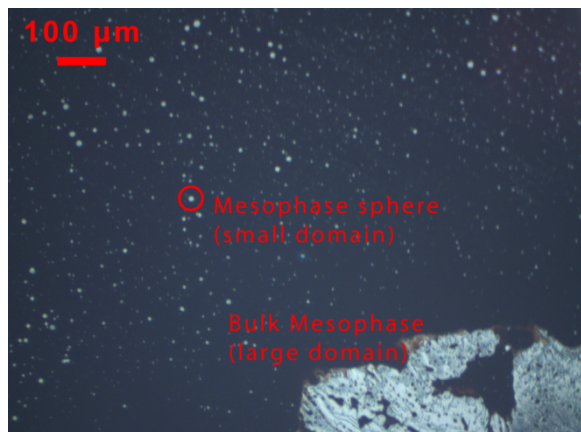


Figure 1. Photomicrograph of mesophase formed during cracking Athabasca vacuum residue under hydrogen at 4.8 MPa and 440°C stirred at 140 rpm, showing coexistence of mesophase spheres (small domain) and bulk mesophase (large domain) formed by stirring after 85 min.