470g Evaluating the Efficiency of Ozawa Theory for the Non-Isothermal Crystallization of N-Paraffins in Solution

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Crystallization is a process of significant importance in a wide variety of industries. In the oil industry, it is of major importance to develop useful methods to prevent wax formation on subsea oil pipelines caused by the crystallization of n-paraffins present in oil. This problem is currently gaining importance from the oil industry's need to drill further and further offshore in order to obtain oil, making the occurrence of crystallization in pipelines more likely. A point of great interest is to better understand the crystallization kinetics of petroleum systems, because better understanding of kinetics has the potential of providing insight into the mechanisms by which crystallization and eventually wax deposition occurs. Numerous models have been developed to model the crystallization kinetics of a wide variety of systems, but a large majority of these models assume an isothermal system, a condition not present in subsea oil pipelines. Ozawa theory has addressed this issue by building on the Avrami equation and has shown to be suitable for a wide variety of polymeric melts, including n-paraffin melts. Therefore, this work focuses on determining if Ozawa theory can be extended from n-paraffin polymer melts to n-paraffin present in solution. Impurities, defined as anything but the chief crystallizing component, can impact all important aspects of crystallization, including the crystallization kinetics. The solvent is of particular interest because it is the most prevalent impurity in solution-based crystallization. Results indicate that the solution based crystallization can be accurately predicted using Ozawa theory only over a certain range of relative crystallinity. This range decreases as the cooling rate of the system increases.