

**Predicting Solids Formation in Cryogenic Hydrocarbon Systems:  
from LNG Plants to Saturn's Moon Titan**

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The formation and deposition of solids during the cryogenic processing of natural gas is a perennial risk for operators. While several tools are available for predicting the temperatures at which heavy hydrocarbon solids will form in cryogenic processing equipment, the Kohn and Luks Solids Solubility Program (KLSSP) from GPA Midstream has become an industry standard. However, although it describes well many of the data sets generated as part of the GPA's research program in the 1970s and 1980s, it suffers from limitations including fixed ranges of temperature, mixture composition, and no dependence on pressure. Furthermore, the available software implementations of KLSSP are not optimized for modern computers. We present here a new software tool called ThermoFAST, which overcomes these limitations and has been endorsed by GPA Midstream recently to replace the KLSSP. ThermoFAST uses a cubic equation of state which is capable of rapidly calculating solid-liquid, solid-vapor, and solid-liquid-vapor equilibrium conditions in addition to normal vapor-liquid phase envelopes. The ThermoFAST model has been tuned to binary mixture data from both the GPA and other literature sources, and thoroughly tested against solids formation data for multi-component LNG mixtures; this includes the formation of solid carbon dioxide over a wide range of operating conditions. We will also describe our ongoing program to advance the industry's knowledge of cryogenic solids formation risk through the acquisition of new data for systems that have not been adequately studied in the past.