# Evaluation of the Crystallization Risk in LNG Production. The Solubility of neo-Pentane in Methane-Rich Mixtures Down to Cryogenic Temperatures

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Despite the fact that heavy hydrocarbons (C5+) are removed in the scrub and fractionation columns upstream of the main cryogenic heat exchanger, traces of heavy compounds are present in the feed of the liquefaction train and may then solidify under cooling during natural gas liquefaction. Following a series of work dealing with the experimental determination of the solid-fluid behaviour of mixtures of methane and BTEX, this paper resumes a series of experiments involving neo-pentane that were carried out at CTP between 2017 and 2022 in collaboration with Shell, Linde, Engie, TechnipEnergies, TotalEnergies, and Aveva. These projects had the objective of developing accurate knowledge on the solubility limits of heavy components in methane in order to avoid oversized purifications units (that reduce the margin in selling LNG) or undersized purification units (that create a loss because of the more frequent maintenance operations).

In this paper, the solubility of neo-pentane in methane, (90% mol/mol) methane + (10% mol/mol) ethane, and (90% mol/mol) methane + (10% mol/mol) nitrogen has been measured from the triple-point temperature of neo-pentane down to 100 K. Measurements have been obtained by different apparatuses implementing both static-analytic (with sampling of fluid phases) and dynamic-synthetic (with phase change detection) methods. Solid-Vapor Equilibrium (SVE), Solid-Liquid-Vapor Equilibrium (SLVE), and Vapor-Liquid Equilibrium (VLE) data obtained in this work have enabled determination of the global phase equilibrium behaviour of the methane + neo-pentane system and have clarified the disagreement between available literature values and modelling results obtained from common equations of states coupled with a fugacity model for solid neo-pentane.