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加工利用

CH_4- CO_2体系固体CO_2形成条件的预测模型

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摘要：

采用膨胀机制冷工艺回收天然气中的乙烷时，膨胀机出口与脱甲烷塔顶部的温度较低，容易发生CO_2冻堵，影响装置的正常运行。准确预测固体CO_2的形成条件，有助于及时采取相应的措施调整凝液回收装置的操作工况，避免CO_2冻堵。为此，分析了CO_2固体的形成条件，根据相平衡原理，采用标准形式的Peng Robinson状态方程建立了液固平衡模型（LSE）和气固平衡模型（VSE），据此分别对CH_4—$CO_2$2气相体系和CH_4—$CO_2$2液相体系中的固体CO_2形成温度进行了计算，并与用HYSYS软件预测的固体CO_2形成温度进行了比较。结果表明：该计算模型的准确度较高，与实验数据的误差在2 ℃以内；而HYSYS软件预测的CH_4—CO_2气相体系的固体CO_2形成温度较实验数据偏高1～5 ℃，预测的CH_4—CO_2液相体系的固体CO_2形成温度较实验数据偏低1～6 ℃。

关键词： 天然气 乙烷回收 CO_2固体 相平衡 Peng Robinson状态方程 LSE VSE

A forecast model for the solid CO_2 formation conditions in a CH_4-CO_2 system

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Abstract:

During the process of ethylene recovery through the expansion refrigeration, the normal operation of the expander will be badly affected by CO_2 plugging due to the rather low temperatures at the exit of the expander and the top of the demethanizer tower. Therefore, precise prediction of the solid CO_2 formation conditions can help the operators to take corresponding measures to adjust the working conditions of the condensate recovery device, thereby to avoid the plugging by the solid CO_2. In view of this, the formation conditions of solid CO_2 is first analyzed, then, based on the principles of phase equilibria, the Peng Robinson equation of state is adopted to build the liquid solid equilibrium (LSE) and the vapor solid equilibrium (VSE) models. With these two models, the forming temperatures of solid CO_2 are calculated respectively in the CH_4-CO_2 gas system and the CH_4-CO_2 liquid system, and are contrasted with the forecasted solid CO_2 forming temperatures by use of the HYSYS simulator. Compared to the experimental data, the calculated results by the LSE and VSE models are of high accuracy with errors within 2 ℃; whereas the forecasted results by the HYSYS simulator are 1~5 ℃ higher in the CH_4-CO_2 gas system and 1~6 ℃ lower in the CH_4-CO_2 liquid system.

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