Coking Analysis Based on the Prediction of Coil Surface Temperature in Radiation Section of Ethylene Cracking Furnace

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Abstract

Ethylene cracking furnace is the key equipment in ethylene industry. Coking\textsuperscript{11} within coils in radiation section mainly affects the life span of ethylene cracking furnace. During industrial production, engineers periodically measure the radiant coil metal temperature which reflects the degree of coking, in order to decide whether to decoking. Nowadays, some devices can be used for the online measurement of radiant coil metal temperature. However, high cost and unacceptable error limit their practical applications. Ethylene cracking process is a well-developed process with a high degree of instrumentation and control, in which a huge amount of operational data has been collected. It also makes it possible to predict the radiant coil metal temperature through the correlations among process data, and further to identify the influence factors of coking during the operation, which would provide a reference to improve the performance of ethylene cracking furnace.

In this work, an industrial ethylene cracking furnace is considered. The correlation between process variables and radiant coil metal temperatures is analyzed according to the structural characteristics and the process information of ethylene cracking furnace, and the process variables with high correlation to the radiant coil metal temperatures are recognized. Based on Partial Least Squares \textsuperscript{2} (PLS), each group of radiant coil metal temperatures was estimated by the obtained process variables with total error level below 1%. Radiant coil metal temperatures predicted by the regression model can be regarded as the indices of coking degree in the radiant coil, which can provide a reference for decoking plan. At the same time, the obtained regression model parameters can be used as a reference for the adjustment to reduce the rate of coking. Therefore, the process of coking within each radiant coil can be synchronized with others and the overall continuous operating time of ethylene cracking furnace can be increased.