

Optimal operation of ash deposits removal system in the pulp process using a machine learning

조형태^{1,†}, 임종훈^{1,2}, 김유림^{1,3}, 박현도^{1,2}, 김태복⁴, 박한신⁴,
김정환¹

¹한국생산기술연구원 친환경재료공정연구그룹;

²연세대학교 화공생명공학과;

³동국대학교 화공생명공학과; ⁴무림피앤피(주)

(htcho@kitech.re.kr[†])

This work, we proposed optimal sequence of operating sootblower for ash deposits removal using a machine learning to maximize recovery boiler efficiency. The proposed modified Q-learning algorithm derived the Q-matrix which is a function that predicts the expected dynamic reward (priority for deposits removal) of performing a given action (sootblowing) and a given state (sootblowing location). The reward is sequentially updated through reward update matrix which consider the decrease heat transfer rate according to ash deposits. To calculate decrease heat transfer rate, the computational fluid dynamics (CFD) model is developed for temperature prediction of each sootblowing locations. In additions, based on the mathematical equation of heat transfer rate and the predicted temperature, reward is defined considering the deposit thickness growth rate and thermal conductivity of ash deposits. To demonstrate the effectiveness of this study, the process model was developed to predict power generation. As a results, the power generation increase by 214 kW without any retrofitting of boiler through the optimal sequence.

Keywords: Ash deposits, Sootblower, Modified Q-learning algorithm