Modeling of the crossing point temperature phenomenon in the low-temperature oxidation of coal

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Abstrak

In this study, modeling of the crossing point temperature (CPT) phenomenon in the low-temperature oxidation of coal was carried out using COMSOL Multiphysics®. Low-temperature oxidation can lead to spontaneous combustion of coal stockpiles. The CPT phenomenon was modeled with the kinetics data obtained from a prior laboratory experimental study. The coupling of the heat-transfer phenomenon through conduction and convection determined the thermal evolution model. In this case, coal received the initial heat of the oven temperature increases. As the coal temperature rose, the heat generated from oxidation was released into the environment via conduction and convection. Meanwhile, oxidation products and oxygen were transferred by convection and diffusion. The effects of moisture and the humidity were not considered. The outcomes of modeling were validated through comparison with the results of experimental tests, and the modeling result agreed well with the experiment tests, with temperature deviations of about 0.9%. The effects of airflow rate, oxygen concentration, porosity, and the initial temperature on low-temperature coal oxidation were also examined.