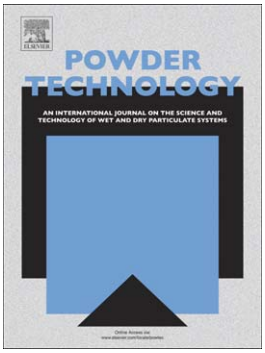

Development of a novel bentonite–acrylamide superabsorbent hydrogel for extinguishing gangue fire hazard

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Development of a novel bentonite-acrylamide superabsorbent hydrogel for extinguishing gangue fire hazard

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Abstract: As a mining waste, coal gangues are prone to spontaneous combustion after being piled, resulting in a series of hazardous environment problems. By studying the spontaneous combustion characteristics of coal gangues in the Dangtong (DT) and Jincheng (JC) mining areas of Shanxi Province, China, it was shown that the spontaneous combustion of coal gangues is closely related to ventilation rates. However, different ventilation rates (10–40 L/min) play different roles in the high- and low-temperature stages. After conducting an adiabatic oxidation experiment of coal gangues with different particle sizes (0–8 mm), it can be seen that the larger the particle sizes, the greater the activation energy required during oxidation and the lower the heating rate. However, a mixed pile of coal gangues comprising particles of different sizes favors self-heating and oxidation of coal gangues. The thermogravimetric (TG), differential scanning calorimetry (DSC), and Fourier transform infrared spectroscopy (FTIR) analyses were applied to study the process of combustion and the factors influencing it. Our test results showed that superabsorbent hydrogels prepared by mixing bentonite powder and acrylamide can be effective to weaken the activities of various oxygen-containing functional groups (such as Si–O and O–H) in coal gangues. Moreover, use of these hydrogels also inhibits combustion and heat release of coal gangues. By comparing the effects of the hydrogel with nitrogen and water in the fire extinguishing experiments, it was