Postprint of Dust Deposition Behavior on the Gas Side of Mining Air Coolers in Hot and Humid Environments

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Abstract

This study investigates the dust deposition behavior on the air side of mine air coolers in deep hot and humid mine environments. First, a simulation experimental platform for dust deposition on the air side of mine air coolers under hot and humid conditions is established. Second, experimental methods are employed to study the deposition behavior of dust particles of different sizes on the air-side wall surfaces of air coolers in hot and humid environments. The results indicate that in hot and humid environments, dust particles are more prone to deposit in the front rows; as the average particle size increases, the fouling layer on the wall surfaces becomes thicker and the deposition morphology appears mud-like. The mass of dust deposition on the air side is directly proportional to the average initial particle size of dust in the inlet air and inversely proportional to the relative humidity, with particles smaller than 40 m being more susceptible to deposition. This research provides theoretical guidance for understanding the fouling generation mechanism on the air side of air coolers in deep hot and humid mine environments and for adopting reasonable anti-fouling and de-fouling measures to ensure effective mine cooling and safe production.

Full Text

Preamble

Dust Deposition Behavior on the Air Side of Mining Air Coolers in Hot and Humid Environments

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Abstract

This study investigates the dust deposition behavior on the air side of mining air coolers operating in hot and humid deep mine environments. A simulation experimental platform was first established to model dust deposition under these conditions. Experimental methods were then employed to examine how dust particles of different sizes deposit on the air-side walls of the cooler.

The results reveal that in hot and humid environments, dust particles tend to deposit more readily on the front rows of the cooler. As the average particle size increases, the fouling layer on the walls becomes thicker and exhibits a mud-like deposition morphology. The mass of dust deposited on the air side is directly proportional to the average initial particle size of the inlet dust-laden air and inversely proportional to the relative humidity. Additionally, particles smaller than 40 m demonstrate a higher deposition propensity.

These findings provide theoretical guidance for elucidating the fouling mechanism on the air side of coolers in deep mine hot and humid environments and for developing effective anti-fouling and cleaning strategies. This research is crucial for ensuring optimal mine cooling performance and maintaining safe production operations.

Keywords: Dust deposition; Coagulation; Hot and humid environment; Mining air cooler

Note: Figure translations are in progress. See original paper for figures.