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Investigation and optimization of urea-water droplet evaporation characteristics for enhanced agricultural and automotive applications

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Abstract:

The Taguchi Orthogonal Signal-to-Noise Ratio (TOPSIS) method is utilized in this study to conduct multi-objective optimization of process parameters in urea solution-containing droplets. By systematically exploring experimental conditions, the study identifies the top three optimal experiments, emphasizing specific substrate materials, temperatures, plate thicknesses, and plate angle orientations. Notably, optimal values for evaporation time and minimum droplet deposition weight are discerned, with a focus on aluminum as a substrate, a temperature of 110 °C, a plate thickness of 1 mm, and a plate angle orientation of 40°. These results offer valuable insights into refining the manufacturing process for droplet-containing urea solutions, thereby enhancing efficiency and performance.

Keywords:

TOPSIS method, Multi-objective optimization, Droplet-containing urea, Process parameter optimization