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Drop splashing induced by target roughness and porosity: the size plays no role

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Abstract

Drop splash as a result of an impact onto a dry substrate is governed by the impact parameters, gas properties and the substrate properties. The splashing thresholds determine the boundaries between various splash modes.

Various existing models for the splashing threshold are reviewed in this paper. It is shown that our understanding of splash is not yet full. The most popular, widely used models for splash threshold do not describe well the available experimental data.

The scientific part of this paper is focused on the description of drop prompt splash on rough and porous substrates. It is found that the absolute length scales of the substrate roughness, like Ra or Rz, do not have any significant effect on the splash threshold. It is discovered that on rough substrates the main influencing splash parameters are the impact Weber number and the characteristic slope of the roughness of the substrate.

The drop deposition without splash on porous substrates is enhanced by the liquid modified Reynolds number. Surprisingly, it is not influenced by the pore size, at least for the impact parameters used in the experiments.

Finally, an empirical correlation for the prompt splash on rough and porous substrates is proposed, based on a rather high number of experimental data.

Keywords: Drop impact, splash, rough surfaces, porous surfaces

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