

Impact of water drops on cold sub-zero surfaces

Antonini Carlo¹, Marengo Marco, Amirfazli Alidad

¹Dipartimento Ingegneria Industriale - Università degli Studi di Bergamo
viale Marconi, 5 - 24044 Dalmine (BG) - Italy
0039 035 2052067, carlo.antonini@unibg.it

A large number of studies in literature is dedicated to single and multiple drop impacts on solid substrates. However, a small number of studies focuses on the effect of the transition from the liquid to the solid phase, of which metal drops are the object of the investigation. The information regarding the impact of water drops surfaces at a temperature below the freezing point is lacking in the literature.

This study presents a critical review of the topic in general and points to the way forward an experimental investigation on liquid water drops impact and solidification. Specifically, the following three issues are examined: (i) identification of the characteristic non-dimensional parameters, needed to analyze the impact dynamic and the heat transfer, such as such Reynolds, Weber and Stephan number; (ii) identification of simple analytical models that can be used to predict drop dynamic and solidification process; (iii) influence of surface wettability, which is commonly quantified by one or more contact angle(s).

Various models were implemented to predict the characteristic time of different phenomena (such as spreading, recoiling, i.e. drop dynamics, and solidification) and to predict the combined influence of solidification and surface wettability on the drop impact dynamics. Assumptions from different models are discussed and results are compared.