

New Insights in the Formation of the Microstructure in Spray Forming of Aluminium Alloys:

From Droplets to Dense Deposits

ABSTRACT

Spray forming can be classified as a two-stage manufacturing process where liquid is disintegrated into a spray of small droplets, droplets solidify in the spray under a relatively rapid solidification condition during their flight and finally ends as the spray deposit builds up on a substrate, with the remaining liquid/semi-solid droplets solidifying at considerably slower rates. Due to a high cooling rate experienced during the atomization, and the special conditions of deposit buildup, with incoming droplets dynamically refining the solidifying material, as-sprayed deposits typically display a fine-scale microstructure, which may also exhibit some extended solid solubility and metastable phases. The formation of the deposit's microstructure is not well understood considering actual solidification models as there are no traces of droplet's microstructure in the final deposit. This talk presents, therefore, a new insight to bring out the prevailing mechanisms during the development of bulk deposits, based on the fundamentals of the solidification theory to explain this open issue in the reported international literature, and in light of the process characteristics points out directions for future developments presenting newly acquired results for aluminum based alloys in our research team.