Extrusion Process Parameters Optimization for the Aluminum Profile Extrusion of an Upper Beam on the Train Based on Response Surface Methodology

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Extrusion process parameters play key roles in aluminum profile extrusion processes. In this literature, by using Box-Behnken experimental design to arrange the simulations using the ALE software HypereXtrude, Response Surface Methodology (RSM) were applied to study the simulation results and discuss the effects of five process parameters, namely billet diameter, billet preheat temperature, die temperature, container temperature, and ram speed, on the outlet velocity distribution uniformity of the profile named an Upper beam on the Train. The interactions between the five parameters also were investigated. Additionally, a second order response surface model between the extrusion process parameters and the evaluation criterion of outlet velocity uniformity was established. An optimization of the process parameters with the purpose to find the most uniform outlet velocity distribution was carried out based on the response surface model. The results show that the three parameters, namely billet diameter, ram speed and die temperature, have significant impact on the outlet velocity uniformity. And there are obvious interactions between these three parameters. After the subsequent optimizations, a more uniform outlet velocity distribution was obtained, and the final acceptable profiles were produced.

Keywords: Aluminum profile extrusion; Optimization; Process parameters; Response Surface Methodology (RSM)

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