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Effects of Polymer Structure and Sintering Kinetics on Final Parts Properties in Rotational Molding

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Rotational Molding is the best method for producing large hollow plastic articles without weld lines. During the processing time, polymer powder melts, then the phenomena of particle coalescence and melt densification occur. After cooling, the molded part is obtained. The understanding of sintering phenomenon, linked to polymer structure, may explain surface defects and bubbles in rotationally molded parts.

Firstly, material properties such as polymer structure, rheological parameters and surface tension were studied and linked to sintering kinetics. The sintering phenomenon was investigated, including coalescence and densification, in order to examine the effect of particle size and shape. Moreover, existing sintering models were compared to experimental data and were improved. Secondly, sintering kinetics were bound to final parts properties. Indeed, samples were molded with a pilot-scale rotational molding machine. On these samples, some defects were detected such as inner roughness, bubbles and surface porosities. Samples mechanical properties were also studied. The effect of particle size and shape on samples properties was examined taking into account the sintering. Quantitative relationships were established.

This work enabled us to model the sintering phenomenon and to bind its kinetics with polymer structure, rheological properties and final parts properties.

Key words: Rotational molding - sintering ·Ecoalescence ·Esurface tension ·Erheological properties ·Eparts properties - defects.