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Rotational Moulding of Polypropylene - nanoCaCO3 Nanocomposites

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The aim of this project was to investigate the ability of nano-scale calcium carbonate (nm-$CaCO_3$) to improve the impact strength of rotationally moulded polypropylene (PP) parts. Injection molded samples were also prepared for comparison. nm-$CaCO_3$ was either blended with powdered PP or melt-compounded into PP. Acrylic acid (AA) with dicumyl peroxide (DCP) were added to assess their compatabilizing effect.
Results show that the addition of nm-$CaCO_3$ leads to an increase in modulus and impact properties in all types of moldings. In rotationally molded parts, the largest increase in impact properties at room temperature is found at 0.3% nm-$CaCO_3$ content while the peak at low temperature occurs for a 1% content. The increase in total impact strength is mostly due to increased ductility and a gain in crack propagation energy. Nevertheless, the impact properties of rotomolded parts are still much lower than those of injection and parts due due to defects such as air bubbles which are an intrinsic part of the rotational moulding processes.
DSC results show no significant changes in the melting or crystallization temperatures nor in overall crystallinity of nm-$CaCO_3$/ PP composites indicating either that the nano-particles did not have a significant nucleating effect. Rheological data shows that low shear viscosity is reduced at low filler content but can increase considerably at 10% filler loading.