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Factors Affecting Beta-Crystal Morphology in Polypropylene During Injection Molding Process

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Different types of alfa and beta nucleators were compounded with polypropylene by using twin screw extruder technique. Various grades of Polypropylene with different melt flow rates were studied in this experiment. Beta-PP compounds were injection molded to prepare the specimens. Molding conditions were varied; key parameters of interest were molding temperature, molding pressure, and cooling time. Mold temperatures were varied in a range of 50 to 120 °C and various molding pressures of 20% to 80% of maximum injection pressure was used. To simulate the isothermal crystallization, the cycle time was set up to 10 min to further anneal beta crystal in the mold. The crystal morphology of beta-PP specimens were studied by using wide-angle x-ray diffraction technique. The different degree of beta crystal content (K value) could be obtained from different processing conditions. DSC analysis was also used to confirm the beta-formation results from WAXD. It was found that higher crystallizing temperature and longer crystallizing time were effective factors to promote beta crystal content. While tensile moduli of beta-PP specimens were lower than common alfa-PP, generally due to the molecular orientation in the samples, the beta crystal enriched PP had higher impact strength and drawability than normal alfa-crystal PP. This study aims at optimizing process condition to produce high beta-PP which could effectively enhance its processability and mechanical properties of the "thin-walled" PP products.