

Optimization of Thermal Parameters to Minimize Air Bubble Defects in Injection Molding of 30% Glass-Fiber-Reinforced Nylon 6

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Abstract: Injection molding is a critical manufacturing process for producing high-performance plastic components, particularly in industries requiring durable and precise parts, such as automotive and aerospace. Glass-fiber-reinforced Nylon 6 (N6 GF30) is widely used due to its enhanced mechanical and thermal properties. However, the formation of air bubbles during the injection molding process remains a significant challenge, compromising part integrity and performance. This study investigates the influence of thermal parameters—nozzle temperature, barrel temperature, injection speed, and cushion settings—on air bubble formation in N6 GF30. A Design of Experiments (DOE) methodology is employed to systematically evaluate these parameters and identify optimal conditions for defect reduction. The findings reveal that precise control of thermal settings significantly minimizes air bubble formation, thereby improving product quality and reliability. The study provides actionable insights for manufacturers to optimize the injection molding process for fiber-reinforced polymers, contributing to advancements in defect reduction and sustainable manufacturing practices...

Keywords: Injection molding, N6 GF30, air bubble defects, thermal optimization, Design of Experiments (DOE), fiber-reinforced polymers

