

Research and Development of Water Assisted Injection Molding Technology

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1. INTRODUCTION

This study is devoted to the research and development of a water-assisted injection molding system for the manufacture of thermoplastic parts. The first part of this report was to develop a water assisted injection-molding system, which included a water pump, a water injection pin, a water tank equipped with a temperature regulator, and a control circuit. Two types of water injection pins were designed and made to mold the parts. The second part of this report is to test the moldability of the developed system on various thermoplastic materials, including polystyrene, polyethylene, polypropylene, and acrylonitrile-butadiene-styrene. A comparison has been made between the parts molded by water assisted injection molding and gas assisted injection molding. The third part of this report is to study the effects of different processing parameters on the molding of water assisted injection molded products. The final goal of this research is to gain better understanding of the moldability of water assisted injection molded parts, so that steps can be taken to optimize the process. This would provide significant advantages in improving parts quality.

2. EXPERIMENTAL

A lab scale water injection unit, which included a water pump, a water tank equipped with a temperature regulator and a control circuit, was developed in our lab as shown in Fig. 1. During experiments, the control circuit of the water injection unit received a signal from the molding machine and controlled the time and pressure of the injected water. Before injection into the mold cavity, the water was stored in a tank with a temperature regulator for 30 minutes to sustain an isothermal water temperature.

Two types of water pin designs were developed in our lab. One is the ring type pin, and the other is the orifice type. The ring type pin has four shallow openings (0.1x2.0 mm in cross section) between the pin body and the cap around the water injection. The orifice type water injection pin has a small orifice at the side of the pin body. Three different sizes of the orifices (0.5, 1.0 and 1.5 mm in diameter) were used.

3. RESULTS AND DISCUSSION

A comparison of gas and water

The temperatures inside the mold cavity