

LASER TEXTURED HYDROPHOBIC SURFACE FOR BLOW MOLDING

FIELD OF INVENTION

The present invention relates to blow molding and in particular blow molding of a polymeric article with hydrophobic properties on the surface of the body.

BACKGROUND OF THE INVENTION

Blow molded articles with hydrophobic surfaces are getting increasingly more attention due to their application in waterproofing and self-cleaning. The word “article” refers to a container for containing materials or liquid-like compositions such as bottles, water containers, jars, tubes, water floatation devices, etc. To be hydrophobic or even superhydrophobic exhibiting good excellent water repellent properties, the water droplets do not adhere to the surface of the substrate, thus rolling it off from the surface and carry away undesirable particles. Hence this action is “self-cleaning” and is prevalent on hydrophobic or superhydrophobic surfaces.

There are various methods out there in the prior art to fabricate hydrophobic surface structures which includes engraving or etching, chemical deposition, electrolytic anodization, or a combination of applying special customised hydrophobic coating followed by secondary processes such as rolling, pressing, stamping, etc. An example of such prior art is found in the patented WO 2013/120001A1 which disclosed the preparation of hydrophobic surfaces by application or coating of certain hydrophobic coating composition on the surface of the mold via either processes such as pressing, rolling or stamping and then having the blow-molded molten material to be in contact with such a coated mold.

The present invention disclosed a polymeric article that can be blow molded with hydrophobic properties achieved via laser texturing on the surface of the mold. This involves separately creating an intricate pattern of micro-scale structures on the mold surface. The use of laser texturing provides a unique method to modify the surface texture of a material, such as mold insert, etc. by depositing large amounts of laser energy onto the surface of a material in an extremely controlled manner. This process creates patterns of micro-scale structures on the mold surface and an extremely high depth resolution. The process can be applied on any material and can be used for texturing complex geometric surfaces. These micro-scale structures looked like hills and valleys with closely spaced grooves coupled with rough top edges which can be either round, curved, squarish etc. For hydrophobicity, studies have shown that the square top followed by nail shape corrugated surface demonstrated least wettability by restricting the penetration of water droplets inside the grooves. Hence any liquid droplet, when in contact with the laser textured surface, the droplet will easily “slide” off, thus the term “hydrophobic”.

The mold used in blow molding can be separately laser textured before the laser textured mold is being transferred to be used for blow molding, either via injection blow molding, extrusion blow molding or injection stretch blow molding. During blow molding, there is the molten parison or preform that will be formed either by extrusion or injection depending on the type of blow molding process chosen. This molten parison or preform is located in-between two (2) halves of a larger mold, which in this case is replaced by a laser textured mold. The molten parison or preform will be air-blown to be expanded such that it will follow the shape and patterned surface of the laser textured mold, simultaneously having the textured pattern imprinted onto the

expanded polymer. This is followed by cooling and ejection of the blow molded part with the textured appearance that is hydrophobic or even superhydrophobic depending on the type of laser texturing being done.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings attached here are to aid comprehension of the description of the invention here. The drawings are not to scale and they are to be used for merely illustrating the principles and concepts of the invention only.

To aid in comprehension of the invention, the drawings are separated into the various Figures as described below:

Figure 1(A), 1(B), 1(C) and 1(D) illustrates an overall cross-sectional view of the laser textured mold being applied onto blow-molding process.

Reference numbers

- | | |
|---|------------------------|
| 1 | Parison / Preform |
| 2 | Mold |
| 3 | Laser Textured Surface |
| 4 | Blow Molded Part |

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT OF THE PRESENT INVENTION

In the following description, details are provided to describe the embodiment of the application. It shall be apparent to the person skilled in the art, however, that the embodiments may be practiced without such details.

The embodiment of the present invention relates to a polymeric article that can be blow molded with a hollow body, whereby the outer surface can be hydrophobic. achieved via laser texturing on the surface of the mold.

Figure 1(A), 1(B), 1(C) and 1(D) illustrates an overall cross-sectional view of the laser textured mold used for blow-molding process. As illustrated in **Figure 1(A), 1(B), 1(C) and 1(D)** illustrates the extrusion blow molding is being used as an example to illustrate how and where the laser texturing will be done and applied. The mold **2** has a laser textured surface **3** as illustrated in all **Figure 1(A), 1(B), 1(C) and 1(D)**. The laser texturing process on the mold **2** is usually done separately using a laser milling machine to texture on the inner surface of the mold that is in contact with the parison / preform **2** as illustrated in **Figure 1(A)**, Once the mold is laser textured, it will then be loaded onto the blow molding process, which in this example would be the extrusion blow molding process illustrated in **Figure 1(A) to 1(D)**.

Figure 1(A) illustrates the mold open position whereby the molten extruded parison or preform **1** from the extruder die is located in-between the two halves of the mold **2** which has laser textured surface denoted as **3**. Once the mold is closed as illustrated in **Figure 1(B)**, the top portion of the parison / preform **1** outside the mold will be trimmed off, followed by using hot air to expand the preform **1** as illustrated in **Figure 1(C)**. The molten parison or preform **1** will be air-blown to be expanded such

that it will follow the shape of the laser textured mold **2**, simultaneously having the textured pattern imprinted onto the expanded polymer. The expanded molded part **4** is then cooled sufficiently depending on the molding parameters set. This is then followed by mold opening as illustrated in **Figure 1(D)**, followed by ejection of the blow molded part **4** with a laser textured appearance that is hydrophobic.

While what has been described hereinabove is the preferred embodiment of the invention, those skilled in the art will understand that numerous modifications may be made without departing from the spirit and scope of the invention. The embodiments described herein are meant to be illustrative only and should not be taken as limiting the invention, which can be expressly set forth in the following claims.

CLAIMS

What is claimed is:

1. A method of blow molding, creating a hydrophobic surface on the outer surface of a blow molded part comprising of:
 - (a) Executing separately the laser texturing of the inner surface of the mold that is in contact with the molten polymeric material (i.e., parison or preform), and followed by
 - (b) Loading the laser textured mold onto a blow molding machine, and followed by
 - (c) Introducing the polymeric material in a molten state (i.e., parison or preform) via either extrusion or injection such that the polymeric material is in between the two halves of the laser textured mold surface, and followed by
 - (d) Closing of the mold with the top part of the molten parison or preform trimmed off, and followed by
 - (e) Introducing air into the molten parison or preform such that it will expand and take the shape and patterned surface of the laser textured mold; and followed by
 - (f) Cooling of the molded part before it is ejected out from the mold with the part having hydrophobic textured surface.