INJECTION MOLDING APPARATUS AND METHOD COMPRISING A MOLD CAVITY SURFACE COMPRISING A THERMALLY CONTROLLABLE ARRAY

Background

Injection molding is often performed in the making shaped polymeric parts. Such molding typically uses two or more mold components (parts) that are brought together (e.g., on platens) to form a mold cavity. Such mold components are often maintained at a generally static temperature, or heated or cooled as a unit.

Summary

In broad summary, disclosed herein are apparatus and methods for injection molding, in which at least one portion of at least one cavity surface that defines a mold cavity, includes a thermally controllable array. In one aspect of the invention, an injection molding apparatus is provided. The injection molding apparatus comprises a mold component comprising a skin comprising at least a front surface. The skin comprises at least one region in which the front surface of the skin defines a portion of a molding surface of a mold cavity. The mold component also comprises at least one temperature-controllable array. The array comprises a plurality of individually temperature-controllable elements that are thermally coupled to the skin in areas of the at least one region of the skin so that the areas collectively provide a thermally-controllable array in the front surface of the skin. At least one of the elements of the temperature-controllable array is laterally thermally isolated from the other element(s) of the temperature-controllable array.

In another aspect of the invention, a process of injection molding is provided. The process of injection molding comprises providing a mold cavity comprising a molding surface comprising at least one thermally controllable array comprising a plurality of areas. Each of these areas is thermally coupled to a temperature-controllable element of a temperature-controllable array. The method further comprises injecting a flowable molding resin into the mold cavity and, altering the temperature of the injected resin within the cavity to cause the resin to solidify the resin into a molded part. At least at some time during the process, a first heat-transfer mechanism and a second heat-transfer mechanism that is different from the first heat-transfer mechanism, are generally simultaneously applied to at least one of the temperature-controllable elements of the temperature-controllable array.

These and other aspects of the invention will be apparent from the detailed description below. In no event, however, should the above summary be construed to limit the claimable subject matter, whether such subject matter is presented in claims in the application as initially filed or in claims that are amended or otherwise presented in prosecution.

Brief Description of the Drawings

Fig. 1 is a perspective view in partial cutaway, into a mold cavity comprising a molding surface comprising an exemplary thermally-controllable array.

Fig. 2 is a front-side perspective view of an exemplary temperature-controllable array and components associated therewith.

Fig. 3 is an end elevated view of the exemplary apparatus of Fig. 2, which view also includes a portion of a mold cavity, shown in partial cross-section.

Fig. 4 is a rear plan view of the exemplary apparatus of Fig. 2.

Fig. 5 is a front-side perspective isolated view of a temperature-controllable element of the temperature-controllable array of the exemplary apparatus of Fig. 2.

Fig. 6 is a side perspective isolated view of an exemplary support member of the exemplary apparatus of Fig. 2.

Fig. 7 is a schematic depiction of a temperature-controllable array and associated components for operating the temperature-controllable array.

Fig. 8 is a front-side perspective view of another exemplary apparatus comprising a temperature-controllable array and components associated therewith.

Fig. 9 is a rear-side perspective view of the exemplary apparatus of Fig. 8.