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DESKTOP VACUUM THERMOFORMING MACHINE

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Abstract

Vacuum Thermoforming is a manufacturing process where a plastic sheet is heated to a pliable forming temperature, formed to a specific shape in a mold, then with help of vacuum sucker air is sucked after that trimmed to create an usable product. Kanthal coil are used to withstand the heat at 400C while heating plastic material. K-type Thermocouple Temperature Measuring for heater to maintain at same temperature. Ceramic foam insulation used for safety while heating. We including bioplastic as a material for thermoforming process. Ex: PLA. We developing a Vacuum thermoforming machine in compact size and low cost compared with market value. Vacuum pressure for Thermoforming process from 2 to 4 bar. We are using all types thermoplastic to create amold.

Introduction

Thermoforming is a process pf shaping a plastic sheet heated above the softening point (Ts) and below the melting point (Tm) of a polymer, and stretching the heated sheet over or inside a mold cavity b rapid application of force. It is widely used in thin wall parts with large surface area.The ability of thermoplastic to therform primarily depends on its softening point, crystallinity percentage, melt strength, and melt elasticity at thermoforming temperature and speed. Thermoforming is a processing technology where a polymer sheet (bioplastic) is heated to a forming temperature and formed under a specific shape in a mold by application of mechanical deformation, air pressure and vacuum pressure.

On/Off Control

An on-off controller is the simplest form of temperature control device. The output from the device is either on or off, with no middle state. An on-off controller will switch the output only when the temperature crosses the set-point. For heating control, the output is on when the temperature is below the set-point, and off above set-point. Since the temperature crosses the set-point to change the output state, the process temperature will be cycling continually, going from below set-point to above, and back below. In cases where this cycling occurs rapidly, and to prevent damage to relays and valves, an on-off differential, or “hysteresis,” is added to the controller operations.

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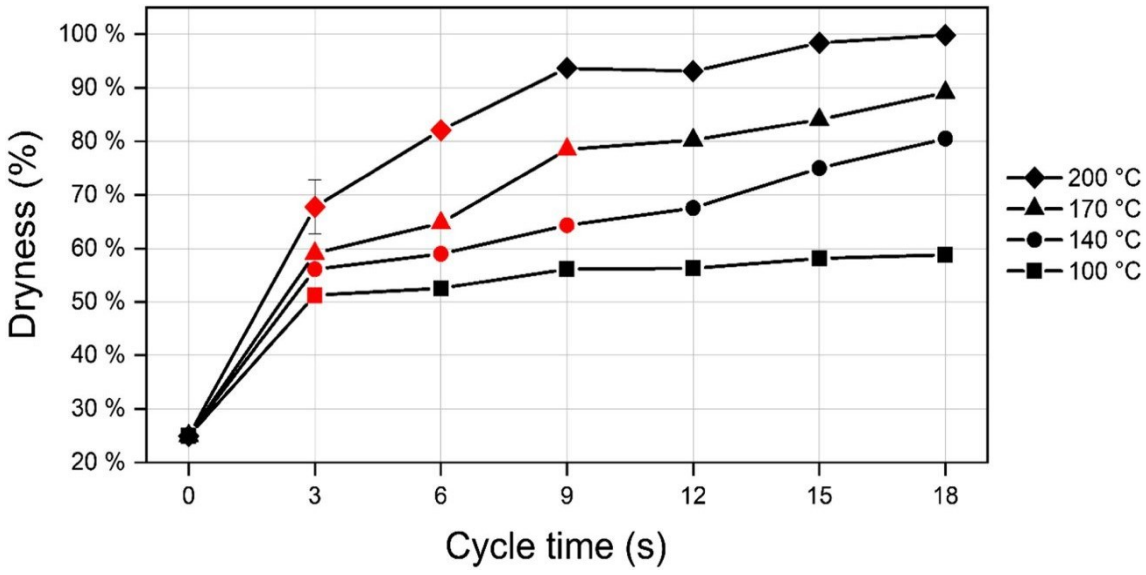
This differential requires that the temperature exceed set-point by a certain amount before the output will turn off or on again. On-off differential prevents the output from "chattering" or making fast, continual switches if the cycling above and below the set-point occurs very rapidly. On-off control is usually used where a precise control is not necessary, in systems which cannot handle having the energy turned on and off frequently, where the mass of the system is so great that temperatures change extremely slowly, or for a temperature alarm. One special type of on-off control used for alarm is a limit controller. This controller uses a latching relay, which must be manually reset, and is used to shut down a process when a certain temperature is reached.

Proportional Control

Proportional controls are designed to eliminate the cycling associated with on-off control. A proportional controller decreases the average power supplied to the heater as the temperature approaches set-point. This has the effect of slowing down the heater so that it will not overshoot the set-point, but will approach the set-point and maintain a stable temperature. This proportioning action can be accomplished by turning the output on and off for short time intervals. This "time proportioning" varies the ratio of "on" time to "off" time to control the temperature. The proportioning action occurs within a "proportional band" around the set-point temperature. Outside this band, the controller functions as an on-off unit, with the output either fully on (below the band) or fully off (above the band). However, within the band, the output is turned on and off in the ratio of the measurement difference from the set-point. At the set-point (the midpoint of the proportional band), the output on:off ratio is 1:1; that is, the on-time and off-time are equal. if the temperature is further from the set-point, the on- and off-times vary in proportion to the temperature difference. If the temperature is below setpoint, the output will be on longer; if the temperature is too high, the output will be off longer.



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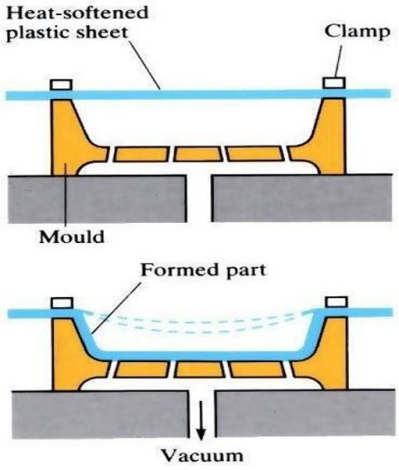
Literature Survey

Thermal and mechanical properties of chemical crosslinked polylactide (PLA) – we have studied about various analysis, properties, experiments and observations of PLA (poly laticacid). Experimental determination of the viscoelastic parameters of K-BKZ model and the influence of temperature field on the thickness distribution of ABS thermoforming - In this paper we studied detailed about thermoforming process and various properties of acrylonitrile- butadiene-styrene (ABS) sheet and thermal analysis.Vacuum forming offers several processing advantages over other forming processes. Low forming pressures are used thus enabling comparatively low cost tooling. Since the process uses low pressures, the molds can be made of inexpensive materials and mold fabrication time can be reasonably short. More sophisticated machines and molds are used for continuous automated production of high volume items like yoghurt pots, disposable cups and sandwich packs. Arduino is an open source platform for building electronics projects. It consists of both a physical programmable circuit board also referred as a microcontroller and a piece of software or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

In our project, Arduino is used to send command signals to the K-type Thermocouple for the monitoring and controlling the temperature by switching on/off the power source.

Specifications:

S.No	Type	Specifications
1.	Microcontroller	ATMega328P- 8 bit AVR family MC
2.	Operating Voltage	5V
3.	Analog input pins	6 (A0 – A5)
4.	Digital I/O pins	14(Out of which 6 provide PWM O/P
5.	Flash Memory	32 KB(0.5 KB is used for Bootloader
6.	Clock Frequency	16 MHz



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Arduino Temperature Controller

Digital Temperature Controller using arduino, here we are using arduino as main controller, this temperature controller controls the temperature of any heating device with given set points, It also displays state of the device either on or off and current temperature.As the name implies, a temperature controller is an instrument used to control temperature. The temperature controller takes an input from a temperature sensor and has an output that is connected to a control element such as a heater or fan.To accurately control process temperature without extensive operator involvement, a temperature control system relies upon a controller, which accepts a temperature sensor such as a thermocouple or RTD and LM35 asinput.

Result and Discussion

The conclusions of this study suggest that knowledge of specific domain improves the results. This Project has been implemented for making the products using bioplastics in order to achieve quick decomposable and put forward to manufacture commercialthings.

It is Eco-friendly where renewably-sourced, biodegradable, recyclable and compostable; Biocompatible – It is non-toxic and Processability – Ithas better thermal processability compared to poly (hydroxyl alkanoate) (PHA), poly (ethylene glycol) (PEG) and poly (γ- caprolactone) (PCL).

It is majorly constructed by mechanical components along with electronic components are used for the purpose of getting the real world data to regulate the mechanicalcomponents.

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