Automated Coating Solution for Plastic Capillary Tubes

Introduction

Ginolis has developed an automated coating solution using the Delilah robotic platform and piezo motor actuated bellows pump, the Ginolis PMB. The automated coating solution applies a hydrophilic solution to a small plastic capillary tube used for collecting blood from a patient, verifies the process with automated visual inspection and cures solution with UV light.

Solution Setup

The automated coating system consists of feeder, Delilah robotic cell, dispensing station and rotation table. The feeder mechanism consists of a hopper and bowl feeder, as well as feeder rail. The Delilah robotic cell is equipped with a high precision Scara arm and custom gripper, which allows for precise and stable movement.

The dispensing/aspiration station consists of a Ginolis PMB 1500 pump, vacuum pump and co-centric needle, also known as a dual functional tip (gauge 25 and 20). Multiple cameras, sensors and positioning software is utilized for process and inline quality control. The final cell, a rotary table, is equipped with loading, unloading, air drying and UV curing sectors.
Coating Process

The coating process begins with the feeder module. The plastic capillary tubes are fed into the hopper feeder, which supplies the bowl feeder with the appropriate number of devices. The bowl feeder and feeder rail orientate the plastic tubes and transport them to the Delilah cell.

The Delilah's Scara arm and customized gripper pick up four plastic tubes from the feeder rail and transfer them at the dispensing/aspiration station. A camera positioning system locates the bottom of the first tube and the co-centric dual function tip. The plastic capillary tube is lowered so that the dispensing tip is inside the capillary tube.
Before dispensing a quality control check is initiated to inspect for any foreign particles and to ensure the plastic tube is intact. Following an affirmative result, the co-centric dual function tip and Ginolis PMB pump dispense a hydrophilic solution into the plastic tube. The quality control cameras check to ensure no air bubbles are present during the dispensing process. Once the tube is full of hydrophilic solution and the result is verified and the solution is aspirated away into a waste bottle. This step is repeated for all four tubes held by the Scara and gripper.

Dispensing the exact amount of required solution inside the capillary tube and the corresponding aspiration process ensure that the coating solution will not splatter and touch the outside, bottom or top surfaces of the plastic tube.

If any of the quality control checks fail, then the tube is consequently moved to the reject station. All capillary tubes that have passed the machine vision quality control checks are placed onto a comb shaped rack on the rotary table. Each comb shape rack can hold a maximum of 40 plastic tubes and there are six racks in total.

The rotary table contains six sectors which include the loading point, three air drying zones and a UV curing station. The final sector is an unloading station where the capillary tubes are placed into plastic bags. The rotation table is fitted with two cooling air fans, exhaust vent and UV lamp fan to ensure proper ventilation. The table also contains sensors to test the UV-light intensity to ensure proper curing takes place.
The automated coating solution is operated using Ginolis’s desktop automation platform, Ginger. The intuitive user interface is easy to use and manage. The equipment surfaces are made from glass, polycarbonate, stainless steel and anodized aluminum, to make the system easy to clean and hygienic.

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