Newport Motion System Enables Flame Test Automation with Shadowgraph Technique

Fire safety of thermoplastic polymers is of increasing importance as household items and consumer electronics become more dependent on these innovative materials. Engineers continue to search for cost-effective fire retardant materials to reduce flammability of thermoplastics while simultaneously discovering new applications and material advantages in the commercial market.

A Newport customer in Bangalore, India is using a test and validation process with a shadowgraph technique in an automated test station to measure flame resistance of polymer samples. The shadowgraph technique allows the capture of a small degree of deformation in polymer samples while a localized flame is ignited. Casted shadow images of the samples are recorded on a CCD camera and analyzed to validate the extent to which the plastic samples under test are flame proof.

During the test process, an accuracy of sample positioning is important for aligning to a target location within a tolerance of several microns. A precise control of exposure time to the heat source is also critical for measurements after the flame is ignited. Another key importance is a flexibility of moving platform to bring the samples at any controlled distance to the flame within a few hundreds of millimeters.

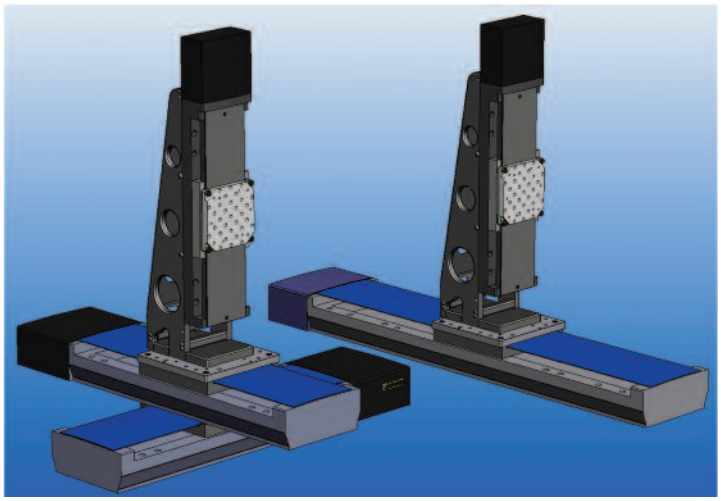

Figure 1: XYZ and XZ stacks with Newport IMS series and ILS series linear stages

Prior to selecting Newport stages, customer used a manual positioning platform which was very time consuming for testing hundreds of samples. Newport ILS series high performance linear stages and IMS series long travel linear stages, combined with the shadowgraph technique and an automation software, helped reduce overall production cycle times greatly, offering superior accuracy, speed and repeatability for travels ranging from 200 to 600 mm.

The automated test station, built on a Newport RS2000 series optical table, consists of three Newport motorized stage assembly stacks, which include burner positioner, pneumatic sample holder and sample stacker. A gas burner is mounted on the burner positioner assembly, which consists of two IMS300CC's and an ILS200CC in an XYZ configuration (Figure 2). A sample holder with pneumatic gripper is placed on the pneumatic sample holder with an IMS600C and an ILS200CC in an XZ configuration (Figure 3). The sample stacker is built with an IMS600CC in a vertical mounting configuration.

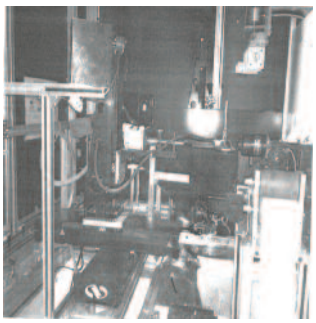

Figure 2: XYZ burner assembly setup in automated flame test station

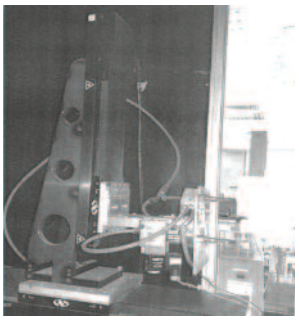

Figure 3: XZ sample picker assembly setup

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Burner on XYZ Assembly:

X Axis: IMS300CC

Y Axis: IMS300CC

Z Axis: ILS200CC

Pneumatic Holder XZ Assembly:

X Axis: IMS600CC

Z Axis: ILS200CC

Sample Stacker:

Z Axis: IMS600CC

An XPS-C8 8-Axis controller drives all motorized linear stages as well as 3rd party motors used in the sample gripper. The customer was able to integrate all components for a fully automated test process with the XPS, using the powerful programming capability of the XPS controller as well as its extensive I/O triggering features to control an external shutter device and a CCD camera.

In the test process, the XPS moves the pneumatic sample holder assembly to the loading position near the stacker assembly. Then, the third party motors, integrated with the XPS, are commanded to move the pneumatic grippers, pick up the sample and load it to the XZ assembly.

As the sample is brought close to the target position near the flame in the burner assembly, the controller opens the universal shutter device and the CCD is triggered using the GPIO digital output on the XPS controller. As the sample casts a shadow on the CCD camera, the burner is ignited and the camera starts recording image deformation from the temperature differential. After the measurement is made for pre-determined time, the sample holder assembly moves back to the loading position for the next sample.

For additional information, please contact Newport sales and application engineers at tech@newport.com. .

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