Production Near Testing of PU Formulations by Using Temperature Controlled Sensors

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- Rise pressure and dielectric polarization measurement
- Testing under simulated production conditions
- Improved reproducibility
- Reduced test times for slow curing formulations
- Enhanced PU Foam and CASE reaction control

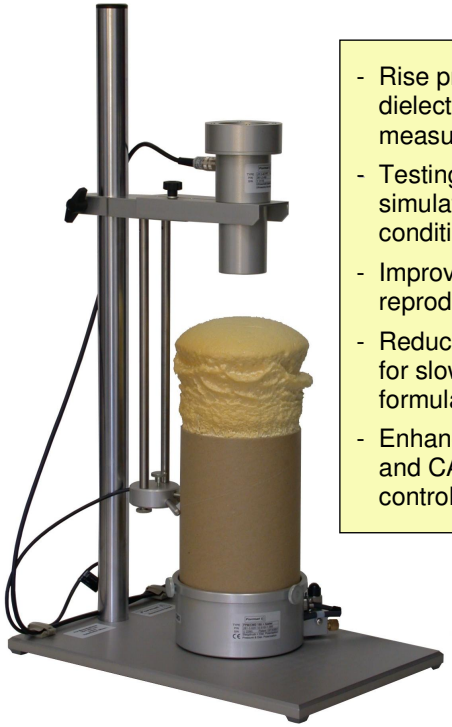

Fig. 1: The new temperature controlled Foam Pressure Measurement Device FPM/CMD 150 is standing in the measurement position of the Foam Qualification System FOAMAT®. It measures the rise pressure and the curing of rigid and flexible foams in combination with the rise height and the core temperature.

The established test methods for PU foam samples measure the rise profile, the reaction temperature, the rise pressure, and the dielectric polarization. Cups, boxes, and test cylinders are used. PU CASE formulations are characterized by their pot life and curing, which is determined from their viscosity or dielectric polarization. Most of the test containers are used at room temperature, whereas in production the mold and the surface temperatures are precisely controlled.

Foam testing:

Undefined test container temperatures spoil the correlation between the test result and the production situation. PIR foams require external heat to react and cure properly. Otherwise these formulations remain sticky and voids appear at the bottom area (Fig. 5). To overcome this, Format Messtechnik GmbH has introduced the temperature controlled foam pressure and polarization measurement device FPM/CMD (Fig. 1). The FPM/CMD is part of the Foam Qualification System FOAMAT®.

With the new device flexible automotive foam systems have been measured at different bottom plate temperatures, showing significant cell structure changes (Fig. 5). The bandwidth of the optimal temperature range is approximately 5°C, which can be proved in real production. The foam pressure and the dielectric polarization signals were affected most significantly by different surface temperatures (Fig. 2).

An advantage of the new precise temperature controlled sensor is the better reproducibility of the measurement data compared to non temperature controlled systems.

CASE testing:

Many CASE formulations require high mold temperatures to react properly and to cure in due time. To test these formulations with the Pot Life and Curing Monitor SubCASE®, a high temperature test container was developed by Format Messtechnik GmbH (Fig. 4). The new device can control test temperatures of up to 110°C.

Slow curing casting components e.g. for electronic encapsulation, have a long pot life making test runs very time consuming. With elevated test temperatures measurements can be completed in reasonable time (Fig. 3).

The new temperature controlled test containers improve established test methods. They also improve the reproducibility of the measurement data. An extended temperature range enables you to measure PIR foams and slow curing CASE formulations almost under production conditions. The new devices are useful testing tools for the polyurethane industry.

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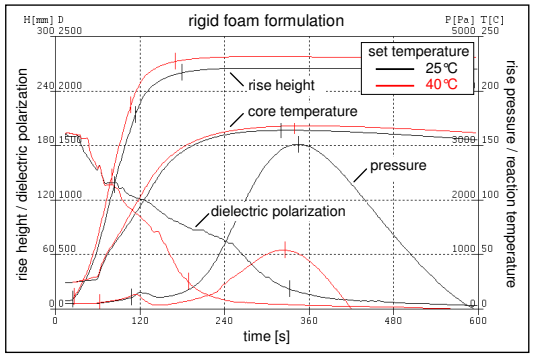

Fig. 2: Two sets of measurement curves of a rigid foam formulation, measured at different bottom temperatures of the test container. Depending on the temperature, the rise pressure and the dielectric polarization show most significant changes.

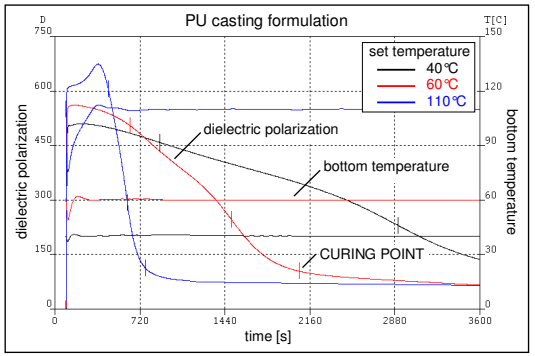

Fig. 3: Three SubCASE® measurements of a casting formulation measured at different bottom temperatures. The dielectric polarization shows strong temperature dependence: Curing goes faster with higher temperatures.

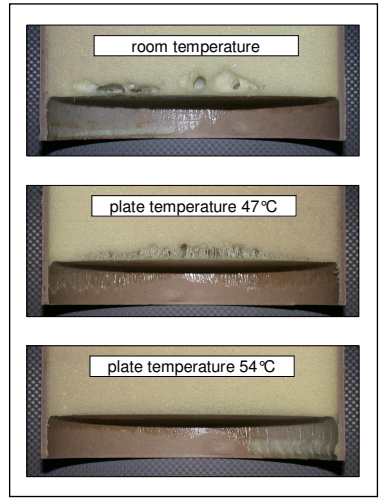

Fig. 5: Cross section of three samples of a flexible foam formulation, measured at three different bottom plate temperatures.

Fig. 4: The Pot Life and Curing Monitor Device SubCASE® and the high temperature test container filled with a white CASE formulation.