

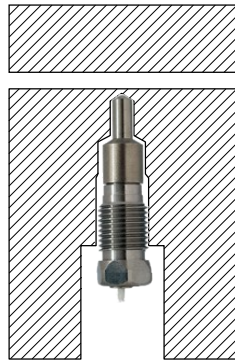
Goals: Material detection, real-time cure monitoring.

Applications: R&D – materials and process, Production with productivity and quality optimizations.

Domains: Automotive, Electrical, Building.

Principle: Pultrusion process is sensitive to material's reactivity which is itself dependent on formulation and thermal conditions. By monitoring heat transfer inside the die at different locations, it is possible to control residence time by acting on pulling rate according to real reactivity of the product.

Sensors location: Sensors are screwed inside the die and remain at 1 mm from the material. They do leave marks onto produced parts and are not exposed to resin leaks.



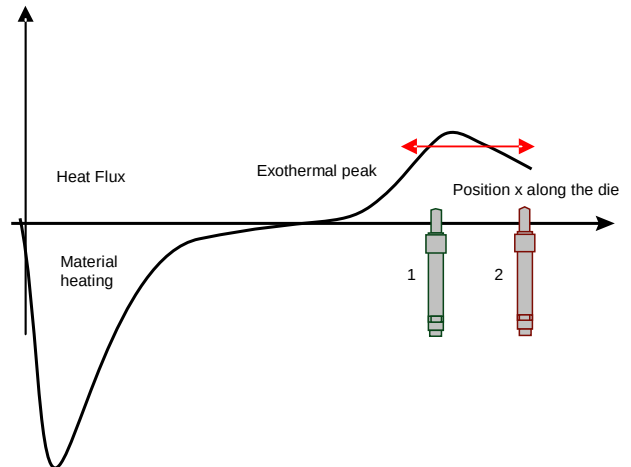
Measured properties:

Heat flux sensors are mainly sensitive to temperature difference between the material and the die. It is then possible to quantify if the die heats the products or if it cools down reaction heat.

Process Control:

The use of multiple sensors let to determine in differential mode if reactive peaks shifts inner or toward the exit. It is therefore simple to increase or to decrease pulling speed in order to maintain reactive zone always at the same position before die output.

Under control, a temperature increase will automatically lead to an increase of pulling rate.



Quality considerations:

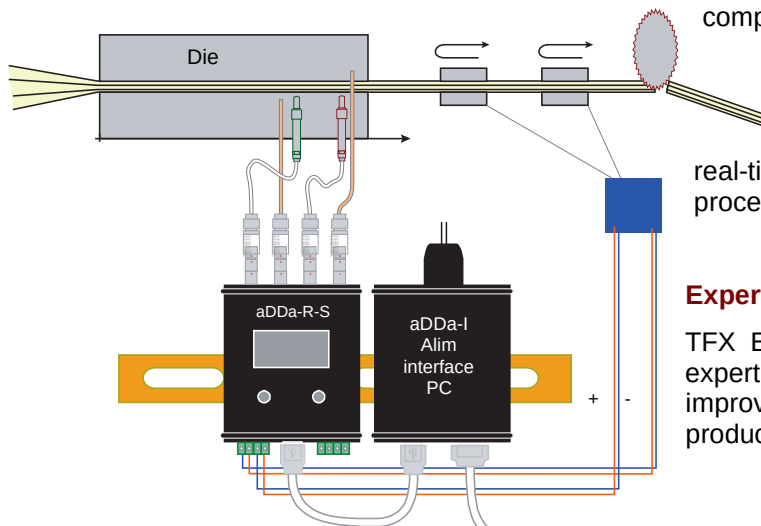
Quality of Pultruded parts do not only depend on cure level, and the pulling rate may be limited by the efficiency of wetting line.

Implementation:

TFX Engineering team will perform the preliminary measurement in order to ensure if thermal regulation is enough stable and if interface is possible with pulling machine.

Sensor will be located according to a thermocouple-given profile along the die and according to existing thermal regulation.

The electronic equipment provided can also input pulling rate and pulling force (0-10V or 4-20mA signals) making possible to built complete process monitoring.



Once installed this tools helps to trace production events; to see on real-time process drifts and to ensure process traceability.

Expertise:

TFX Engineering conducts also complete expertises on long-time runs. This helps to improve existing processes and optimize production methods.