

## **CAMELIA IR**

Infrared infusion monitoring system based on infrared imaging

#### DESCRIPTION

The monitoring of infusion process inside the air circulation oven through the infrared thermographic imaging is made according to an installation composed of :

A. An IR (infrared) Camera to monitor the floor area of the oven. This camera can be according to the oven dimensions a High End IR camera or a Basic one.

- B. A specific window
- C. A fixture to maintain the camera

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D. A software " **CAMELIA iR** " to be implemented by our **ANIFIB**, oven process controller.

The infrared camera is placed outside the oven wall and delivers accurate thermographic imaging and repeatable temperature measurements across the tooling.

The distinct advantage of the infrared camera is that it provides temperature reading across the entire surface area of the tooling in complement of just the localised information provided by contact-based thermocouples.

CAMELIA IR is used to monitor the uniformity of resin wet out in the fabric during the infusion process in the moulds and measures the uniformity of resin impregnation as it flows into the kerfs of composite core materials.

Furthermore, the temperature profile during the infusion process can be used to detect exothermic events and assess the degree of cure of the top layer of the curing composite.

#### **CAMERA INFRARED**

A fix mounted infrared camera can be installed in a position (generally on top of the curing oven) viewing the length of the tooling in order to monitor the infusion process by detecting and measuring temperature differences.

The compact infrared camera is fully controlled by the operation process controller of the oven (our computer ANIFIB). It streams high resolution images at a selected rate and it communicates via high speed protocol.

The commanding software is specifically developed for the intended application and provides high speed live images in to the operation console of the oven, records the temperature variation.

The acquired data allow the correlation of the temperature and the thermal evolution to (i) the flow front and (I) the degree of cure at the top layer of the composite.

Note: For very long oven ( ex 20 m ) two windows can be installed to install two separate cameras as the viewing angle can be limited to 7,5 m long



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#### SPECIFIC LENSES

These lenses are selected according to the Oven dimensions. Specifications on request.

#### ▶ WINDOW ON OVEN INSTALLATION





Figure 1. Infrared Camera front view installation

Figure 2. Window on the oven

#### **SOFTWARE FOR TEMPERATURE DATA PROCESSING AND IMAGING**

Custom infrared imaging capture and analysis software; linked to our ANIFIB Control Software for the Oven complete process and coordination of Infusion phases.



Figure 3. Thermal imaging of infusion process when the flow front reaches the middle of the panel. Resin flow advance direction is from left to right. The temperature scale is in °C.



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Name	Function
Control functions	Adjust the camera configuration parameters and focus as the live image is viewed – use of stored preset configuration values
Camera calibration	Assessment and full control Image capture Capture and gather images (at set intervals or on user command) via FireWire/USB or Ethernet interface
Temperature data capture	Generates a true temperature image from a 16-bit image acquired from USB or Ethernet interface
Control temperature value	Supply the temperature at a predefined spot area to the temperature control module (visual process control possibility)
Temperature data analysis	Scanning of acquired temperature maps for derivation of maximum and minimum values, heating / cooling rates, temporal variation at specified spot areas (up to 12 across the window), index of temperature uniformity
Temperature data processing	Estimation in real-time of resin degree of cure at specified spot areas (up to 12) and assessment of potential exothermic event - based on user selected kinetic model
Data storage	Recording to file of images, temperature maps and temperature analysis at predefined intervals or on user command



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#### **FURTHER RESTRICTIONS ON MATERIALS FOR ACCURATE IR THERMOGRAPHY**

The topmost material (visible by the IR camera) should have as high as possible emissivity in the wavelength range of the camera (7.5-13 m). This will be satisfied for most vacuum bagging materials. The desired emissivity of the topmost layer is greater than 0.85. (Vacuum films have by 0,98)

It will not help the accuracy of readings if a bleeding cloth or any other fabric will be placed on top of the vacuum bag during infusion.

#### ► INSTALLATION



Figure 4. Layout of camera positioned on top of the oven. The viewing area on the tool surface is L x W.

Storage conditions: it is recommended to store at temperature from +10°C until +30°C in the original packing. Warranty period: 12 months