Precidium[™] Rail Floor

Thermal Conductivity Measurements

Novel Experiments using Heat Flow Meter

Laser Comp FOX50 – 190GAP

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Background

The FOX 50 Heat Flow Meter measures thermal conductivity according to **ASTM C518 and ISO 8301**. The FOX 50 uses thin film heat flux transducers, digital thickness measurements, temperature control, and an integrated contact resistance correction to perform a measurement. Covering a wide range of temperatures, the FOX 50 is an ideal choice for measurements of medium conductivity materials such as plastics, ceramics, composites, concrete and more [1].



Figure 1: Heat Flow Meter placed in CRN laboratories of UBC

Operation procedure:

- 1) Samples are placed between the two plates of the chamber
- 2) The upper plate remains still while the bottom plate is moved with a pneumatic ram to ensure contact of the sample and the two plates.
- 3) A temperature gradient measured with a type E thermocouple is established over the thickness of the material.
- 4) The heat flux passing through the sample is measured using two thin film heat flux transducers on either side of the specimen surface
- 5) Finally the thermal conductivity is calculated by the measured heat transfer and physical properties of the material (thickness, contact area).

The working principle of this device is using Fourier's law:

$$Q = \frac{\lambda A(\Delta T)}{(\Delta X)} \quad [W] \qquad (1)$$

This equation can be rewritten in to find thermal conductivity.

$$A = \frac{Q(\Delta X)}{A(\Delta T)} \left[\frac{W}{mK}\right] \qquad (2)$$

Q/A: Heat flux [W/m2] ΔT: Temperature Gradient across the Plates [K] ΔX: Specimen Thickness [m]

Procedure and Results

A free film of Precidium[™] Rail Floor was provided by Quantum. It consisted of a base membrane, with a red topcoat and black and gold accent spots. 50mm diameter samples were cut from the sample for testing using a cnc waterjet machine.

60 psi pressure was used to eliminate contact resistance.

Testing was performed at room temperature as standard procedure, followed by testing again at 120°C due to request by Quantum.

Specimens	Thermal Conductivity [W/mK]
Room Temperature	0.263
120°F	0.278

 Table 1: Thermal Conductivity Results



Figure 1: Cross section of Precidium[™] Rail Floor sample provided for testing