

# calmetrix

## I-CAL FLEX



### CALMETRIX I-CAL FLEX FOR ADVANCED TESTING OF CEMENT

#### Background: Isothermal Calorimetry in cement testing.

Isothermal calorimetry measures the heat generated by a cementitious binder in a tightly controlled temperature environment. The thermal power is used as a continuous measurement of the rate of reaction, which itself is a determining factor for engineering properties such as workability, set and early strength development. Calorimetry is widely used to perform research and development of new materials and processes in the cement industry.

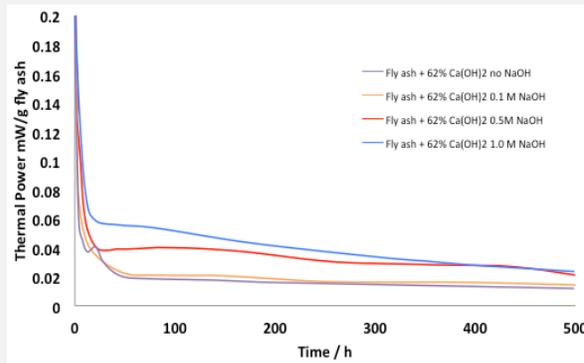
#### I-Cal Flex for advanced precision testing of cement and pozzolanic materials.

The I-Cal Flex is an advanced Isothermal Calorimeter for up to 8 sample channels of differential measurement with variable references. It is designed to be ideally suited for measurements that require a high level of precision or very long-term testing. The I-Cal Flex can carry up to eight individual plug-and-play calorimeters using glass or HDPE vials. Users can choose the number of calorimeter cells they want to install, between one and eight channels. Each calorimeter can be taken out or plugged back into the thermostated chamber individually at the user's discretion, and is calibrated using its own embedded electrical calibration heater. The I-Cal Flex is the only isothermal calorimeter where each sample cell is completely isolated from the others, thereby completely eliminating any cross talk and resulting in unparalleled precision and stability. The high precision thermostat spans a temperature range from 2 °C to 90 °C, with a stability of +/- 0.001 °C over an indefinite time period, thereby extending the potential of very long-term testing over periods of several weeks or months. The I-Cal Flex's baseline drift and noise levels are the best in its category among any cement calorimeters. Optional accessories are available for internal mixing and injection of water and admixtures. Naturally, the I-Cal Flex is fully compliant with ASTM C1679, ASTM C1702, ASTM C563, ASTM C1897, RILEM R3 and EN196-11.



I-Cal Flex is connected via USB connection to a Windows PC that is delivered jointly with the calorimeter. Data generated by the I-Cal Flex is retrieved and analyzed with Calmetrix's state-of-the art CalCommander 2.0 software, which can be used in multitasking mode for data analysis even while collecting data for a new experiment. Featuring a new design for use with touchscreen computers and an emphasis on user friendliness CalCommander 2.0 offers cement scientists a series of tools for easy determination of setting times, compressive strength, activation energy, sulfate optimization and heat of hydration testing. Users can also easily create customized reports and export data into their own analytical software tools.

**Example: long-term reactivity testing**  
(Applicable Instruments: I-Cal Flex)



Supplementary materials such as fly ash typically react slowly with calcium hydroxide generated by the hydration of clinker. One can measure the reactivity of supplements directly by using a simulated Portland Cement environment consisting of a mixture of calcium and alkali hydroxide, as would be found in a Portland Cement after several days of hydration.

The graph on the left shows a comparative reactivity test for a low calcium fly ash sourced from a power plant in India. The results show that for this fly ash, the effect of an increase in sodium hydroxide concentration is quite substantial, which is possibly attributable to a relatively high content of amorphous material.

I-Cal Flex is a powerful tool for long term studies of materials like seen here, that exhibit a low heat of reaction.

**Superior performance with true internal mixing.**

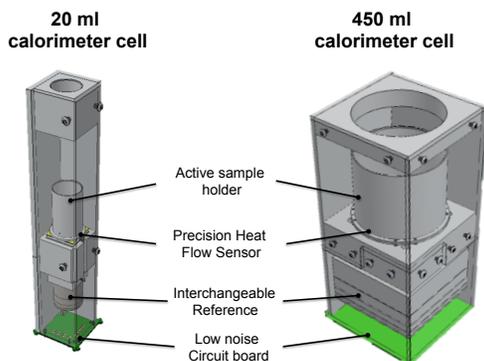


Advanced mixing in I-Cal Ultra

Most internal mixer alternatives in the market frequently fail to mix properly, for example at the 0.4 w/c ratio mandated by EN 196-11. The I-Cal Flex 20 ml admixture testing vial and advanced mixing accessory is the only true mixer in the market. Motor and manually controlled with adjustable speed, it uses a unique and patent pending vibrating mechanism to ensure that sample materials are properly dispersed and mixed completely. In this picture, one can see comparative results of a cement paste mix at 0.4 water/cement ratio. The vial on the left side a conventional mixer, with incomplete dispersion and poor mixing. The vial on the right shows the Calmetrix I-Cal Flex advanced mixer, with high dispersion and superior mixing.

**Specifications.**

The I-Cal Flex has the highest performance of all microcalorimeters in its class. With individual calorimeter cells that are completely isolated from each other, cross-talk is non-existent. A high precision thermostat, with tightly controlled air flow and optimized design of calorimeters gives the I-Cal Flex a baseline that is ten times more stable than that of its closest competitor, and a precision of +/- 2 µW.



Specifications	
Operating Voltage	110 - 240 VAC - 50/60Hz
Sample size	'Up to 20 ml / up to 450 ml
Operating Temperature Range	2 °C to 90 °C
Temperature Stability	+/- 0.001 °C
Temperature Accuracy	+/- 0.15 °C
Detection Limit	2 µW
Dynamic range	500 mW (adjustable)
Precision*	+/- 2 µW
Accuracy of Enthalpy measurement*	0.1%
Number of test channels	1- 8 (user defined)
Baseline* (24 hours)	
Drift	< 5 µW
Short-term noise	< +/- 1 µW
Dimensions	L20"xW16"xH44" (50 cm x 40 cm x 108 cm)
Weight	75 lbs (34 kg)

\* as measured in 20 ml calorimeter at 23 °C. I-Cal Flex is an instrument suited for high precision testing in an advanced research laboratory setting. Optimal performance and conformance with specifications is achieved when placed in a climate-controlled room according to standard research laboratory conditions.