Testing Ceramics

Description

Installation QC for Boilers

Ceramics are used as refractory materials in boilers and furnaces. When these ceramics are in the form of fibrous bundles, the effective thermal conductivity is related to the compression during installation. The effusivity will be affected by the compression of the bundles as well as the thermal conductivity. If a poorly installed or a compressed bundle is located and replaced before firing, thermal efficiency of the furnace could be improved. Also, long-term operational life may be extended if a 'weak link' was removed because stresses would not concentrate in that area. The Mathis TCi may be used as an installation QC device. The interfacial and portable qualities of the device make it only alternative to check thermal conductivity of an installed product.

Experimental

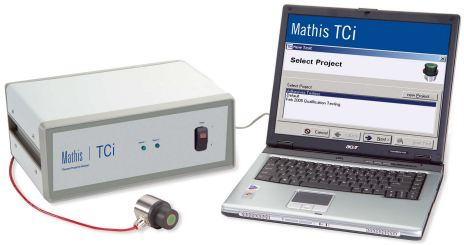
Cyclic Heating Degradation Evaluation

When the ceramic brick or fibrous bundles are installed they are in a pre-fired or “green” state. When the boiler or furnace is fired, the high temperature bakes the ceramic materials into a glassy state. The material shrinks slightly during the baking and continues to do so over its life. Also, with continued use, the hours at elevated temperatures cause the ceramic to precipitate several chemicals. This precipitation leads to the eventual break down of mechanical strength.

The Mathis TCi technology may also have applications in determining projected life expectancy of boilers that have been operating for several years. The interfacial technique may be sensitive to the precipitation and resulting change in thermal conductivity. This would allow for tighter control of a boiler’s replacement projections.

Instrument

Mathis TCi (50℃ up to 200℃).



Results

New Material Evaluation

At one American university, the Mathis technology presented researchers the opportunity to test small experimental ceramic samples non-destructively. Previously, the research group had been using samples that were larger than desired in order to conform to the 50 mm (2 in) diameter specifications of the laser flash method for testing thermal conductivity. This was expensive, as it wasted material and was destructive in nature. To go along with these drawbacks, the group was paying $1000 per test. The Mathis Technology technology is different. It is interfacial and can test any flat surface greater than 17mm in diameter non-destructively. Test times are as short as 1 second. After testing with the Mathis TCi, other testing equipment may still be used, as the samples have not been destroyed. This is an important criteria for researchers. The speed and absence of sample size restriction gives the Mathis technology an advantage in studying experimental formulations.