Thermal Erosion Tester

Product: Thermal Erosion Tester

Development Stage: Prototype Complete

Primary Inventor: Sam Ramrattan PhD, Professor, Dept. of Industrial/ Manufacturing Engineering

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Chemically bonded and green sand cores and molds (coated or uncoated) are a key part of metal casting technology. Their behavior, when contacting molten metal during casting, is of crucial importance for creating a quality casting with exact tolerances.

Friability is a measure of sand's abrasiveness, and it increases, when sand and binder (sand composite) are heated by molten metal, and when pressure increases on the molds and cores during pouring of the molten metal. The heat transfer and increased pressure causes thermo-chemical reactions attributable to the shaped sand composite that result in mold dimensional changes, distortions, and increased friability leading to erosion of the sand. The erosion of more friable sand limits the use of deep pockets in molds because the sand from the top half of the mold is flushed into the bottom half of the mold, causing a defect in the casting. Refractory coatings can be used to improve mold and core surface finish, and reduce sand defects such as erosion, but they are costly and cannot compensate completely for instabilities of the sand composite.

The presently used American Foundry Society (AFS) friability test apparatus does not heat the sand composite sample and does not apply pressure to the sample during abrasion testing. The AFS apparatus fails to simulate real-world conditions encountered during casting for the testing of friability.

Technology Description

Dr. Ramrattan has developed an advanced Thermal Erosion Tester (TET) to create a realistic assessment of composite friability encountered by the sand mold, by measuring abrasion of a composite sample (uncoated or coated) at the actual metal pouring temperature and pressure.

The TET allows setting temperature and pressure parameters to reflect those anticipated during casting. An automated data acquisition system collects, stores and plots data on; abrasion time, temperature of the metal probe that abrades the sample, pressure exerted by the metal probe on the sample, and the amount of sand abraded, in real time. A graph is generated that shows specimen mass change as a function of time.

Because of the accuracy of the TET, foundry clients are now able to improve sand system control. This permits development of robust, high tolerance composite sand formulations to meet new industry requirements for greater quality.

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Potential Benefits

- Real world friability determined by applying casting temperature and pressure to sample
- Durability of composite determined by measuring sand abrasion in real time
- Computer control of all test parameters, and data collection and output