Bentonite Clay Performance Testing

The new Bentonite performance testing procedure is used to look at Bentonite clays and their ability to perform as a foundry binder. Using testing procedures out of the AFS Mold & Core Test Handbook and other testing resources within the Metal Casting Center, these tests were able to compare different Bentonite clays to determine what they were able to endure when used in a foundry. Western (Sodium) and Southern (Calcium) Bentonite clays were used in the project to compare and contrast the performance of the clays used. The results also provided a look into different ways to improve poor performing Bentonite clays to potentially increase their performance when used in an industrial setting.

Optimization of New Phenol and Formaldehyde Free Urethane Binders

These binders help eliminate VOCs to improve the working environment, improve emissions, and further improve the efficiency in the core making and casting process. In order to eliminate VOCs in the working environment, testers located zero VOC solvents that were compatible with base material and efficiently adjusted viscosity. To improve emissions testers located environmentally friendly based materials. Finally to further improve the efficiency in the core making and casting process testers adjusted chemical compositions to alter physical and chemical properties of resins for better sand coating, cure times, shakeout, surface finish, and penetration.

Core Shakeout Test

Test cores can be produced in several types of sands and binder processes. Molds can also be produced from different types of sands and binders. The test casting design was developed by Ashland Casting Solutions and can be poured in various alloys. This allows different casting temperatures along with core burn out rates. Various core binders and aggregates can be evaluated for ease of core removal. Test pieces are clamped in the shakeout tester, vibration is applied, and sand is caught in a funnel mounted above a scale. The sand is then collected on the scale placed below the funnel. Results show how long different sands and binders can take for core shake out. Sands and binders can be tested for best shake out times due to binder amounts, type of sands, and speed and ease of core sand removal. Future plans for this project include; Accelerometer for measuring the vibration force, development of an AFS standard procedure for core shakeout, and metal mold for simulation of semi permanent molding conditions. This research is being conducted in the Metal Casting Center at the University of Northern Iowa in conjunction with the AFS 4N Pollution Prevention research committee.

Core Sand Vibration Tester

The casting containing the core sand to be vibrated and retrieved for weight to time measurement is placed in the jaw of the Herschal knockout hammer, where the hammer applies hydraulic clamping pressure to hold the casting during vibration. Once securely clamped, air is applied to the hammer, causing hammering and vibration to the casting, which transfers the vibration through the sands, breaking the remaining bonds, and allowing the sand to exit through the bottom escape hole. The vibrations will be set for all tests at a regulated pressure (PSI) to maintain consistency throughout all tests. The pressure applied to the hammer hydraulically will also be regulated to assure the same and equal clamping pressure to all molds to maintain consistency of vibration transfer. These factors may be changed for different castings, such as aluminum, iron, or steel. The sand is captured and weighed from the start of the vibration through the entire test. A scale is set on an independent stand to ensure little vibration will have an effect on the measuring of the scale. The scale is connected to a data analysis program where the sand weight and time of the sand weight can be simultaneously measured. The vibrations, type of sand and binder, and type of casting can all be used to calculate the value of the weight to time of sand and binder removal.

The vibrator is mounted on a plate that is mounted to palletized stand by means of vibration isolators. These isolators were chosen because of their rigid weight capacities, ability to maintain the weight of the knockout hammer, the mounting equipment, and the clamp. The isolators also restrain the movement of the hammer to allow for easy capture of the sand within a smaller area.

The stand is heavily built to resist outgoing vibrations, ensure stability throughout the entire test, and be able to stay in the same shape and condition without the loosening of hardware. The design of the stand will also allow for heavier shakeout tests, and the ability to hold added weight for stability and added vibration dampening.