

New Products from Coal Combustion Ash: Selective Extraction of Particles with Density < 2

**Tapiwa Gurupira¹, Charles L. Jones¹, Allen Howard¹, Cal Lockert²,
Tracy Wandell³ and John M. Stencel¹**

¹Center for Applied Energy Research, University of Kentucky, 2540 Research Park Drive, Lexington, KY 40511; ²Stock Equipment Company, 16490 Chillicothe Road, Chagrin Falls, OH 44023; ³Sphere Services Inc., 123 Leinart Street, Suite 205, Clinton, TN 37716

KEYWORDS: construction products, beneficiation

ABSTRACT

Spherical and hollow fly ash particles having density < 1g/cm³ are known as cenospheres. Their concentration in coal combustion ash is typically << 1%; as a consequence, their value is relatively high (~\$0.70/kg). However, cenospheres are really particles containing gas bubbles independent of their density. Hence, cenosphere densities can vary between 0.6 g/cm³ to near or greater than 2.0 g/cm³. They can constitute up to 80% of some fly ashes, but there is no economic way of selectively extracting them.

We report on the selective extraction of cenospheres, defined as particles having bulk densities < 2 gm/cm³, from combustion fly ashes by the use of a specially-designed, pneumatic transport, triboelectric separation system. Processing at feed rates up to 20 kg/hr, the concentration of low density products were measured by float-sink analysis plus centrifugation. The float-sink media included distilled water and lithium metatungstate, the densities of which were varied between 1.0 gm/cm³-to-2.0 gm/cm³. Pneumatic transport, triboelectric separation tests to optimize product selectivity are described. The products were analyzed by optical and scanning electron microscopy, He pycnometry and laser granulometry. Depending on the ash, an overall product density of near 1.6 gm/cm³ could be obtained. They would be useful for creating lighter-weight ceramics and building materials, and for specialized coatings.

