

GENERATION OF GRAPHITE PARTICLES BY ABRASION AND THEIR CHARACTERIZATION

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ABSTRACT

Characterization of graphite particles (dust) produced by abrasion that would occur in an operating pebble bed reactor is of interest for reasons of safety, operation, and maintenance. To better understand this abrasion and particle generation, I have completed two independent tests using a custom in-house, designed and built, testing system. One test of sliding abrasion and one test of spinning abrasion was conducted, both in a 1% - 5% relative humidity air environment. I have used both a commercial non-nuclear grade graphite denoted, GM-101, and a nuclear grade, MLRF1, from SGL Carbon for these tests. For spinning abrasion, GM-101 and MLRF1 were used. For sliding abrasion, only GM-101 was used. I have obtained size distributions for the abraded particles, fit lognormal functions to those size distributions (for use in computer codes), determined particle shapes, measured temperature and humidity during the tests, measured surface temperatures at the contact point of the samples, calculated wear rates, measured the surface roughness of both pre-test and post-test samples, measured particle surface areas, measured pore volumes, and pore volume distributions of particles produced during abrasion of graphite surfaces under different loadings and sliding speeds, or rotational speeds, for both experiments. The experiments showed that as loading (analogous to pebble depth in the reactor) and rotation speeds or sliding speed increase, so do wear rates, concentration of particles and particle surface area. The upper limit on the size of the abraded particles that was observed was less than about 4000 nm in both tests. The shape of the dust particles was in every case non-spherical. In all, our research shows that pebble abrasion is a complex process that is not constant during operation and thus should be considered for future work.