# FRICTIONAL COMPOSITES FROM COAL COMBUSTION BY-PRODUCTS

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ABSTRACT

Massive quantities of inorganic by-products are generated when coal is burned or gasified and when flue gases are scrubbed of sulfur dioxide. Therefore, the utilization of by-products is of great economic and environmental importance. One utilization approach will be to convert coal combustion by-products (CCBs) into value-added frictional composites. In order to accomplish this, we systematically probed: (a) how the concentration of PCC fly ash and FBC spent bed ash controls the mechanical and thermomechanical behavior of composites formed from different ashes, (b) how the presence of CCBs in our composites affects the specific heat capacity and thermal conductivity, and (c) how ashes control the wear and frictional characteristics of our composites. To answer these questions, the structural, thermal, and thermomechanical properties of our composites were evaluated by conducting scanning electron microscopy (SEM), differential scanning calorimetry (DSC), dynamic mechanical analysis (DMA), and Fourier transform infrared (FTIR) measurements. While the wear and frictional behaviors of our composites, as well as those of commercially-available automobile brake pads, were tested using frictional assessment screening test (FAST). We found: (1) The fly ash concentration beyond 40% had a deleterious effect on the mechanical properties of our composites. (2) Both fly ash and bottom ash affected the wear and frictional characteristics of the composites though effects were dissimilar. (3) At lower temperatures ($< 160^{o}$C), the commercial brakes had thermal conductivity, which was higher than our brakes. However, this trend was reversed at temperatures greater than $200^{o}$C. (4) The comparative wear and friction tests on our brake composites and on commercial automotive brakes indicated that our composites' wear characteristics were competitive with commercial brakes.