

Ceramic Tiles from High-Carbon Fly Ash

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Only about 20% of Illinois fly ash is utilized, mostly by the cement and concrete industry. Utilization of fly ash as a major ingredient in manufacturing ceramic tiles can reduce the raw materials cost and provide a competitive edge to U.S. manufacturers against foreign competition.

The project included laboratory characterization of the materials, scale-up investigation in a custom tile manufacturing facility, and trials with large-scale industrial equipment.

A process was developed that allows utilization of fly ash with moderately high carbon content in manufacturing ceramic tiles. A method was developed that leads to oxidizing the residual carbon, thus removing a potential source of tile warping, surface defects, and loss of strength. The approach was based on allowing sufficient time for the tiles at the holding temperature, sufficient for carbon oxidation before the liquid phase formation seals the system of pores supplying oxygen to the tile's interior. Subsequently, tiles were heated to a temperature when sintering and fusion combined to form a tile body with low porosity and adequate strength.

The pilot-scale experiments and successful runs on the actual mass-production, industrial-type equipment indicated that characteristics of fly ash-based tiles are superior to those required for wall tile applications, and comparable to those required for floor and outdoor applications. The developed processing method has general applicability to other Class F fly ashes as well. It has also been confirmed that fly ash tiles with low water absorption can be made at temperatures significantly lower than those required for conventional ceramic tiles.