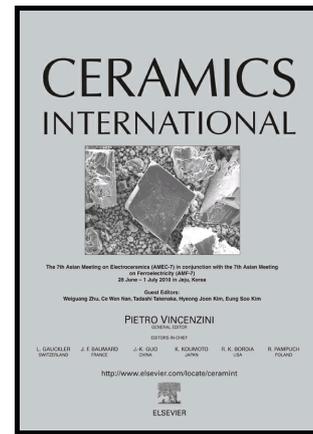


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## PRODUCTION OF CERAMICS FROM COAL FURNACE BOTTOM ASH

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### ABSTRACT

Furnace bottom ash (FBA) is generated in significant quantities from coal fired power stations and is a problem when commercially viable reuse applications do not exist locally. Representative samples of FBA from the Kilroot power station in Northern Ireland have been milled, pressed and sintered at a range of temperatures to form new ceramic materials. The effect of adding recycled glass to the mix has been investigated. The optimum FBA ceramics were produced by sintering at 960°C and these had a density of 2.388 g/cm<sup>3</sup>, zero water adsorption indicating minimal open porosity, and a Vickers hardness comparable to commercially available glass-ceramics. The addition of 20% by weight of glass reduced shrinkage during sintering, while the samples maintained high density and hardness. This glass addition allows greater dimensional control during sintering to form FBA ceramic tiles. The research demonstrates that FBA can be processed into ceramics for use in higher value products compared to conventional use as lightweight aggregate. Further research is required to optimize processing and fully characterize material properties. This novel approach to managing FBA has potential to transform a problematic waste in Northern Ireland into a valuable resource.

### Keywords

Furnace bottom ash, glass, glass-ceramics, reuse, circular economy, sintering.

### 1. Introduction

Kilroot coal fired power station, situated on the north shore of Belfast Lough in Northern Ireland, generates 520 megawatts (MW) of electricity from dual coal and oil fueled generators. It is the only coal-fired power station operating in Northern Ireland and produces approximately one third of the country's electricity. Furnace bottom ash (FBA) is produced from agglomerated coal ash particles which do not carry over into the flue gas during coal combustion. The EU currently uses ~1.9 million tonnes of FBA, 47% as aggregate, 42% in road construction and 10% as a raw material for cement production [1]. However, while some FBA produced at Kilroot is used to produce building blocks, excess FBA is available and this is either stockpiled or landfilled with coal fly ash.

The development of higher value reuse applications for FBA represents an opportunity for innovation and new industry in Northern Ireland. Producing new ceramics incorporating previously unused materials has potential to allow the recycling of large amounts of wastes, particularly non-renewable mineral resources that are not dissimilar in composition to the ceramic bodies used in roof and floor tiles [2].

The production of ceramics and glass-ceramics using coal fly ash has been extensively studied [3-6] and the effect of soda-lime glass addition to glass-ceramics made using the petruirgic method has also been reported [7]. Waste minerals from other mining processes have been incorporated into ceramic tiles [8]. However there has been relatively little research reported on using FBA as the primary raw material to produce ceramics [9].

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