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Grain Size Analysis of Class C Fly Ash used for Aluminium-Silicate Binders Production

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1 Introduction

In recent years, many different kinds of cementitious materials have been developed. Many of them were alkali-activated cementitious materials. It is mostly because of their high strength and durability. Moreover they have got very low environmental impact due to emissions of greenhouse gasses which was subject by Błaszczyński and Król (Błaszczyński *et al.* 2014, 2015). Most of used in civil-engineering and infrastructural construction fly ashes are type F. The reason of that is because of their excellent properties and wide spectrum of application. Much worse properties, especially in use as additives to cements and mortars gives usage of type C fly ash. According to Yang, Zhang and Wang (Yang *et al.* 2008), aluminosilicate materials obtained from alkali-activated class F fly ash have main binding phase as the amorphous hydrated alkali-aluminosilicate (Krizana *et al.* 2002; Haha *et al.* 2011 and Guo *et al.* 2010) proved that the major binding phase in alkali-activated ground granulated blast furnace slag similarly like in type C fly ash is calcium silicate hydrate (C-S-H). Because of this fact, main goal of this paper is to present future possibilities of treatment which could increase application range and utilization of C type fly ash.

2 Materials

Fly ash from brown coal combustion with a significant content of calcium compounds was used for the research. In the determined samples, the CaO content ranged from 15 to 24%. The chemical composition of tested fly ash is given bellow (Table 1).

As the activator, an aqueous solution of potassium hydroxide was used.

Table 1. Summary of the chemical composition used for testing fly ash.

Type of fly ash	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	MgO	CaO	Na_2O	K_20	Ignition losses
TYPE C	44,17	21,79	4,58	1,85	1,49	21,06	0,23	0,19	4,64

3 Results and Discussion

The most favourable in terms of maximum fragmentation turned out to be grinding time of 60s. Further increase in grinding time caused the opposite effect agglomerates began to form in the material. The next stage of treatment was subjecting the material to an ultrasonic wave, making the sample with the largest fragmentation become a milled sample for 120 [s]. The degree of comminution described by the specific surface in this case corresponded to the obtained compressive strength of the tested samples (Figure 1).

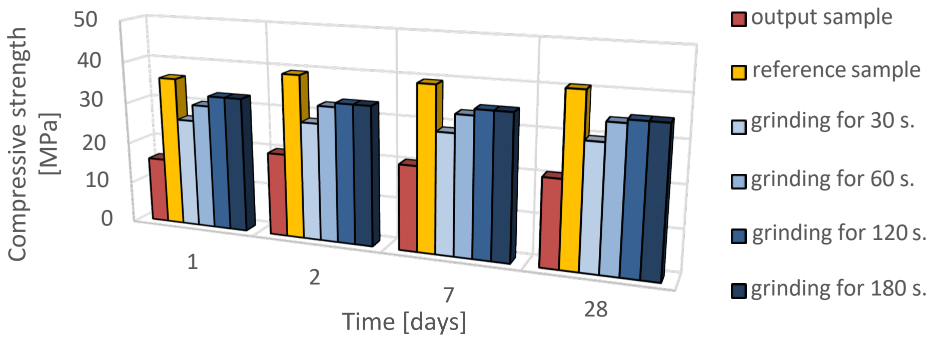

Figure 1. Compressive strength of samples made of treatment fly ash.

4 Conclusions

The strength results show three basic relationships. First of all, milling of ashes has a significant impact on the achieved compressive and tensile strength of the tested samples. The most effective in terms of strength parameters of samples obtained from the tested ashes is the milling time of 120 s. Its increase did not cause a significant increase in compressive strength and in the case of tensile strength even a decrease in strength. The use of a mix of ashes with different grinding times had a positive effect on the increase of compressive and tensile strength as well as the ratio of these strengths. This was probably caused by a change in the form of granulometric distribution, which has a major impact on the rate and degree of geopolymerization.

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