THE EFFECT OF ADDING MICRO AND INORGANIC NANOPARTICLES ON PROPERTIES OF GEOSILICATE CURED AT TEMPERATURE

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Abstract

The paper deals with the influence of micro and nanoparticles of dust from the production of glass basins as an addition to geosilicates for the properties of these materials. The basic material was geosilicate based on inorganic bicomponent, aluminosilicate bases activated by alkaline activator. For the maturation of geosilicates, was used shortened technology using elevated temperatures. Mechanical properties, especially tensile strength, compressive strength, and structural and behavioral change at elevated temperatures were studied on the materials.

Keywords: Geopolymer, glass basins dust, Baucis 160 L, electron microscope

1. INTRODUCTION

Geosilicates, also referred to as geopolymers, are alkali-activated aluminosilicates. They are known as a material that produces up to 50% CO2 emissions, material for isolation, concrete repair and heavy metal and radioactive waste fixation. They have advantageous mechanical and thermal properties. As with cement, their properties and application depend on the type, size and shape of the bristle. Thus, the material thus understood is a composite where the geosilicate represents the matrix and the filler has a reinforcing function. Another advantage of alkali-activated aluminosilicates is their presence in both the extracted materials (metakaolin produced by kaolin and clay) and in waste materials (slag and fly ash). Waste materials can be used also for filling. In the submitted paper, dust from the production of glass basins is used as filling. These are made of sodium-activated clay activated clay, so in this case geosilicate must be said.

2. ALKALINE ACTIVATED ALUMINOSILICATES

Aluminosilicates have the general formula

(Na, Kn {- (Si-O) z -Al-O} nww2O) (1)

and the chemical reaction is described as polycondensation, i.e., the water release reaction. Alkali in the production of geosilicates represents water glass, NaOH, or. KOH. [1] It is necessary to emphasize the silicate module, i.e. Si / Al ratio. [1, 2] Chemical reactions are extensively described in a number of publications and are not described in this paper.

3. EXPERIMENTAL PART

The Baucis L 160 geopolymer from the production of Czech Straw [3] and the alkaline activated clay from Keramo Plus, Verneřice as the basic material entering the experiment. Samples were mixed and labelled as shown in **Table 1**.

Table 1 Layout of mixtures

Designation	Geosilicate	Activated dust
G0	100%	0%
GP5	95%	5%
GP10	90%	10%
GP20	80%	20%

The percentage of activated dust was determined in relation to geopolymer cement

Mixing was carried out in such a way that the solid phases were first mixed together and then an activator was added. Stirring was continued for 20 minutes, and then the mixture was shaken on a shaking table to remove air bubbles. This operation took place for 1 min. Mixing indicated that the GP20 mixture could not be processed to the required consistency and was therefore excluded from further experiments.

The blends were formed by pouring into sample moulds to test mechanical properties for prism bending 40x40x250 mm and for pressure tests of rollers with a diameter of 28 mm and a height of 50 mm. The rolls of the rollers were ground for testing. Tests were carried out on the TIRA dynamometer.

4. CONCLUSION

The results of bending strength and compressive strength are shown in **Table 2** and in the graphs of **Figures 1 and 2**.

Table 2 Bending and compressive strengths

Designation	Bending strength [kPa]	Compressive strength [kPa]
G0	14, 44	73, 7
GP5	10, 41	69, 9
GP10	13, 59	55, 6

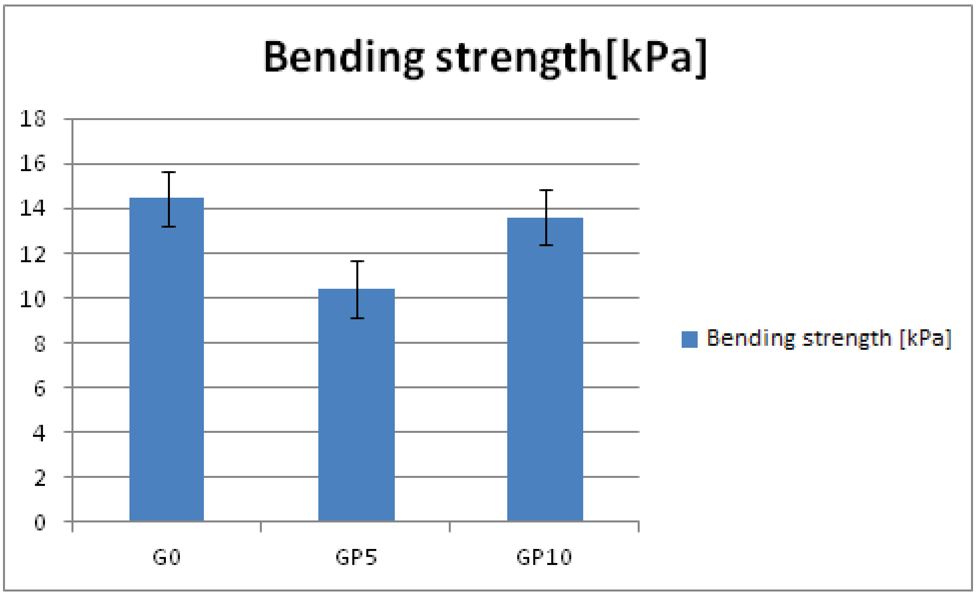

Figure 1 Graph of bending strengths

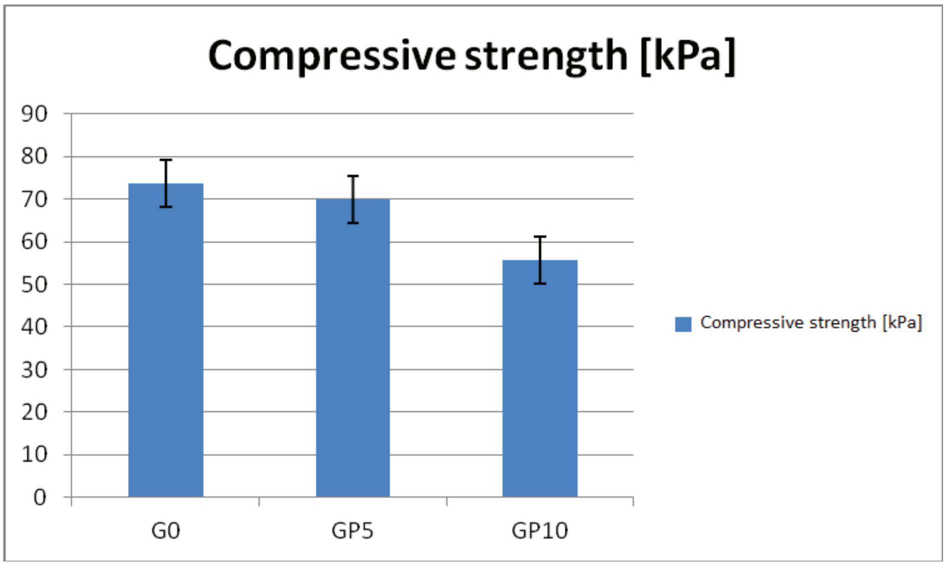

Figure 2 Graph of compressive strengths

From the graphs of **Figures 1** and **2**, it can be seen that the bending strength G0 and GP10 have values within the statistical error and GP5 is low. Compressive strengths, on the contrary, are strengths G0 and GP5 within the statistical error and lower values are obtained by GP10. This discrepancy must be seen in a non-homogeneous structure, will need to perform more tests in the experiment

Figures 3 to **6** are Baucis L 160 images, activated dust and composite structures GP5 and GP10.

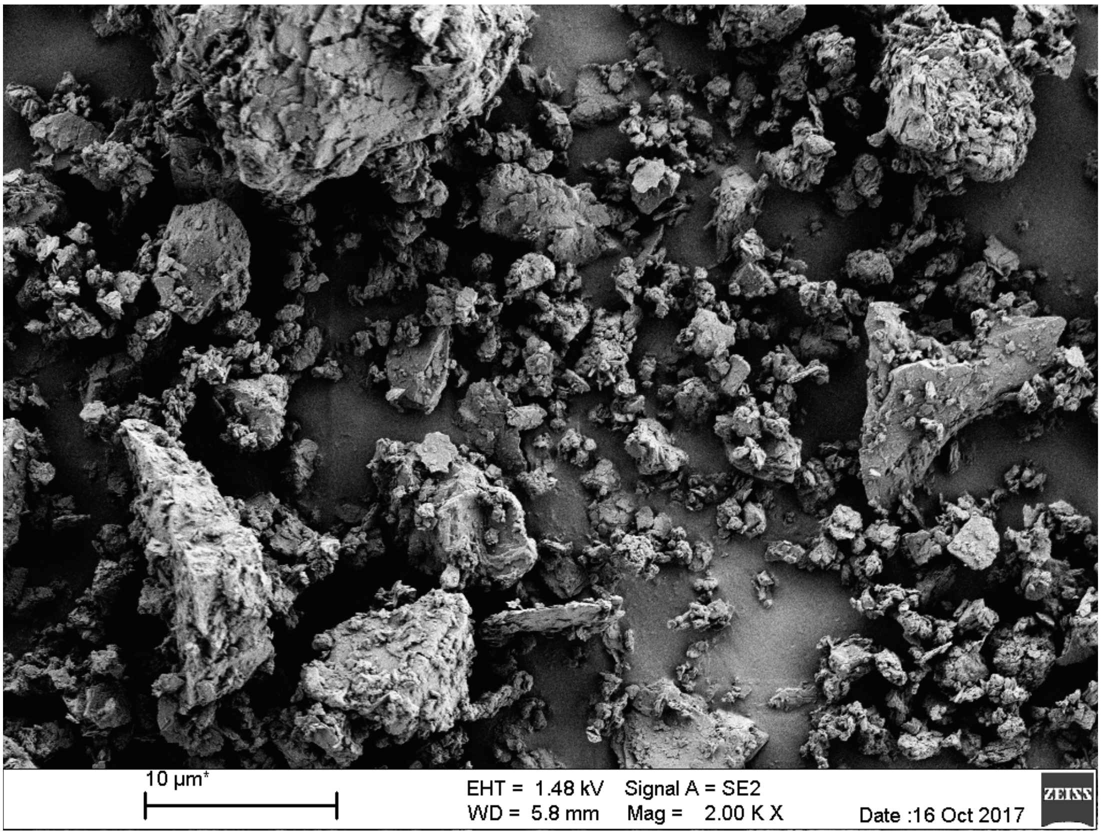

Figure 3 Particles Baucis L 160

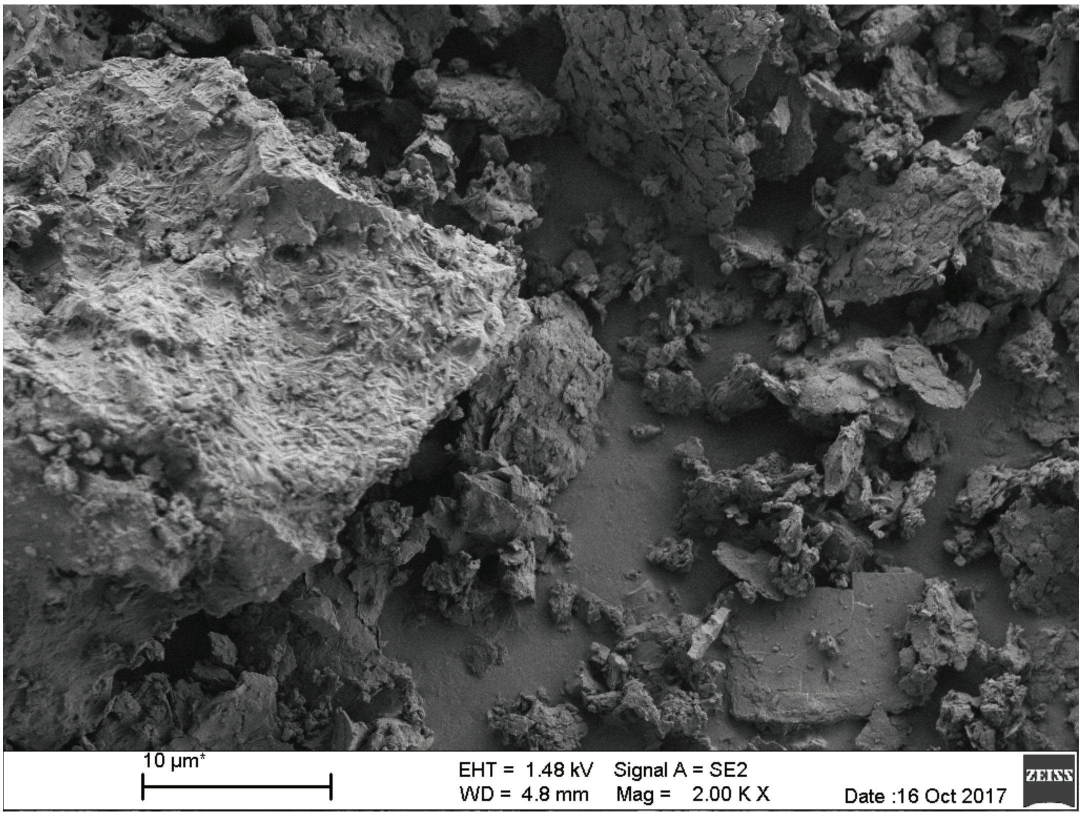

Figure 4 Particles of activated dust

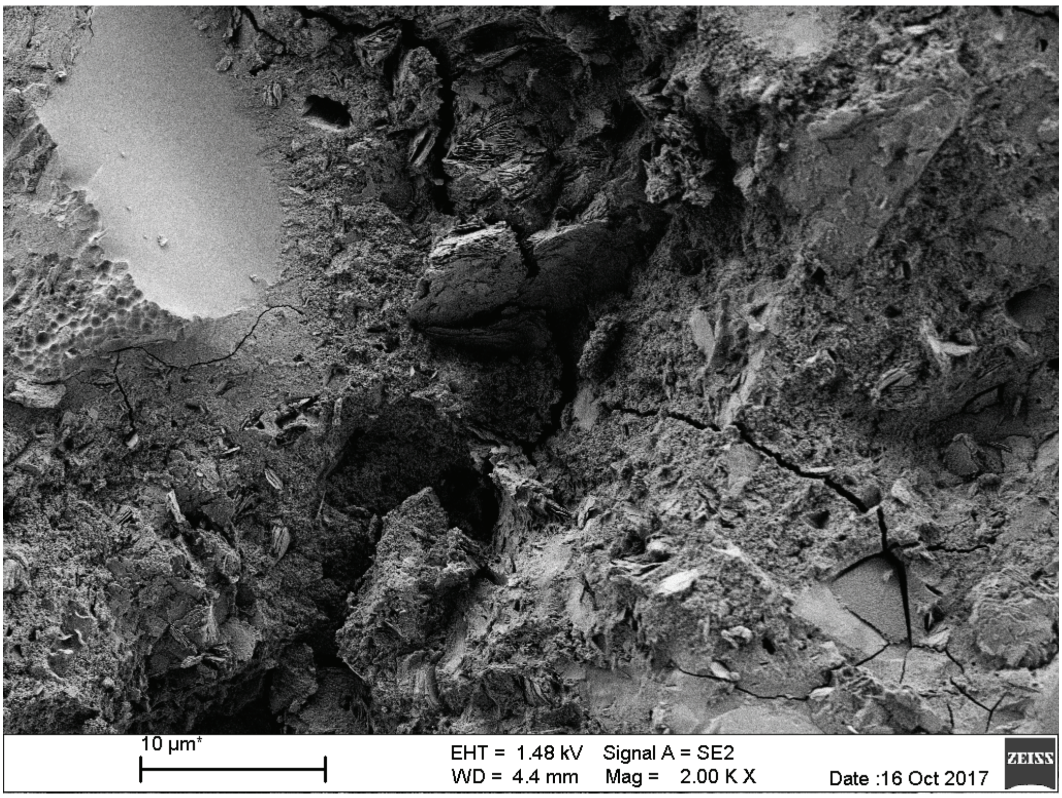

Figure 5 Structure GP5

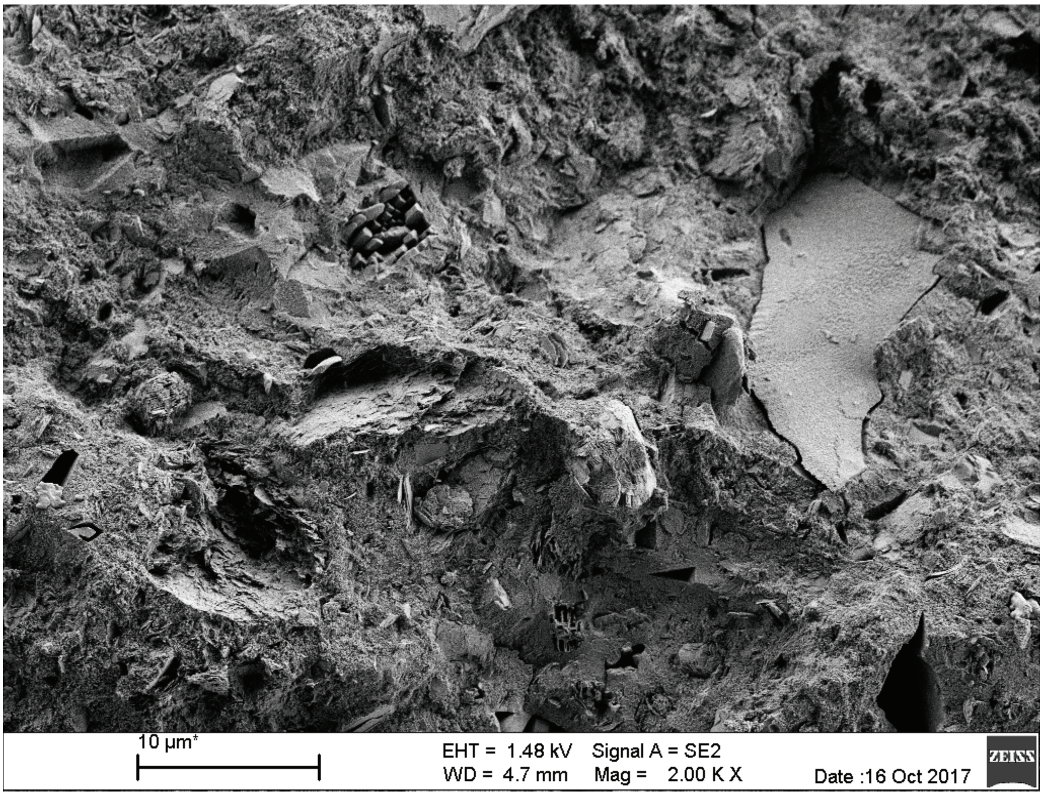

Figure 6 Structure GP10

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[3] http://www.cluz.cz/en/geopolymers-general-information September 1st 2017 cited