

Development of 3D Printing Technology for Geopolymers

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1 Introduction

Nowadays, the using geopolymers for 3D printing in the large-format printer is a great challenge. It offer a new perspectives for the construction industry, but the development of this technology is connected with a lot of barriers. The article shows the main idea of the advanced large format 3D printing for geopolymers with using an ergonomic printing method as well as materials research in modern filaments in the form of geopolymers. It is focused on problems that appear during the first trials of development 3D printing technology.

The basic properties are connected with possibility of effectiveness 3D printing process are viscosity and time of bounding (Labonnote *et al.*, 2016; Rahul *et al.*, 2019). This basic properties are connected with the thixotropic, that is understood as high yield strength and low viscosity behavior of the materials and they include (Labonnote *et al.*, 2016; Panda and Tan, 2019):

- pumpability - reliability with which material is moved through the delivery system,
- extrudability - depositing material through a deposition device,
- buildability - resistance of wet material to deformation under loads,
- and open time - period during which the aforementioned properties remain consistently within acceptable tolerance.

The basic challenge is received the material that is sufficiently fluid and at the same time have sufficient viscosity to retain its shape after the printing process (Panda and Tan, 2019; Panda *et al.*, 2018). Moreover, not only the material properties decided about the possibilities of effective process. The other elements connected with technology are also important. All of this factors happen that there is only a limited understanding of the material requirements for 3D printing technology (Labonnote *et al.*, 2016; Rahul *et al.*, 2019).

2 Materials and Methods

Samples were prepared using sodium promoter for activation the metakaolin with some pigment addition. The trials has been made on the laboratory 3D printer for concrete – WASP 2040 with pneumatic feeder.

3 Results

The samples some multilayers plate have been prepared using 3D printing method – Figure 1.



Figure 1. Page layout.

The printed samples were characterized by different quality.

4 Conclusions

The most important problems was viscosity the material. It was regulated by ethanol addition. After receiving the required viscosity the main challenge was layer stability. The other challenge was brittle material behavior after the curing time and cracking during the drying process. There are planned further work on material stabilization.

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