

## ALKALI ACTIVATION OF GROUND FLY-ASH

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*This paper describes chance of milling and grinding of fly-ash. In paper is compared energy intensity with regards to grinding time and mean diameter of fly-ash grains size. Another theme of this paper is possibility of alkali activation of this grounded fly-ash, physical-mechanical characteristics of alkali activated fly-ash binder measured on fly-ash paste and, of course, fly-ash concrete mixtures. On test samples were compressive strength, specific gravity, density, and especially the porosity, which is determining factor for other physical and mechanical characteristics, measured.*

*There is shown, that with grinding and milling of fly – ash is possible to increase reactivity and accelerate the process of fly-ash activation. This process evokes some negative effects, at most creep and shrinkage.*

*Since 2003 has been proceeding research work of fly-ash alkali activation. This work is provided by the Department of Construction Technology, Faculty of Civil Engineering, CTU in Prague and the Department of Glass and Ceramics ICT Prague. The final goal of this project is the usage of alkali activated fly-ash from big coal power plants into building industry.*

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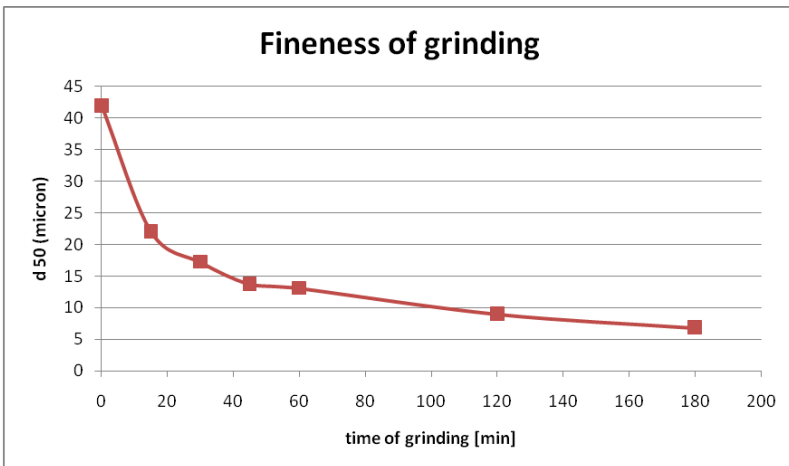
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## Introduction

Test samples were prepared with different ways of fly-ash alkali activation. The first way of alkali activation is preparation in heating chamber at temperature 80°C for 24 hours – it is marked as heat cured samples. Second way of activation is at temperature 20°C – it is marked as ambient cured samples. Effect of grinding was confirmed in both events. The growth of compressive strength was negative, because of shrinkage.

## Characteristics of fly-ash grinding

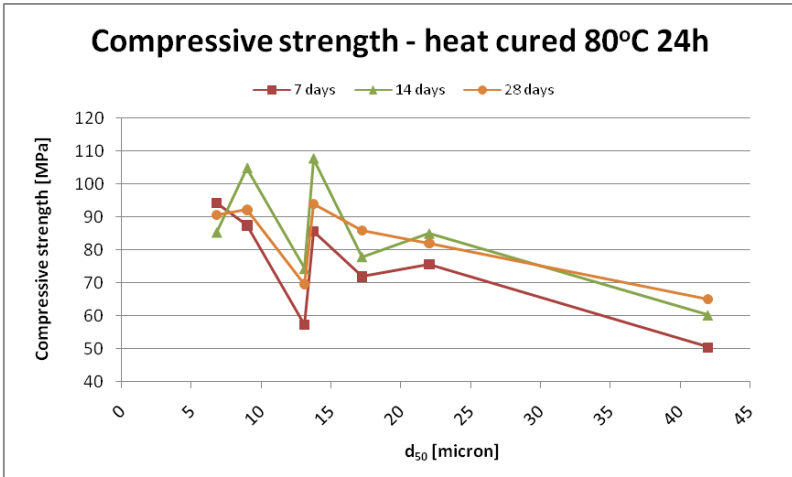
Fly-ash was used from Opatovice coal power and heating plant. This fly-ash was grounded in Los Angeles type grinding mill in Výzkumný ústav maltovin in Radotín – Prague. Six different samples of fly-ash were prepared. Time of grinding was 15, 30, 45, 60, 120 and 180 minutes). Mean diameter of grain size with regards to time is shown on graph 1.



**Graph 1 Sizeclass mean diameter of fly-ash with regards to grinding time**

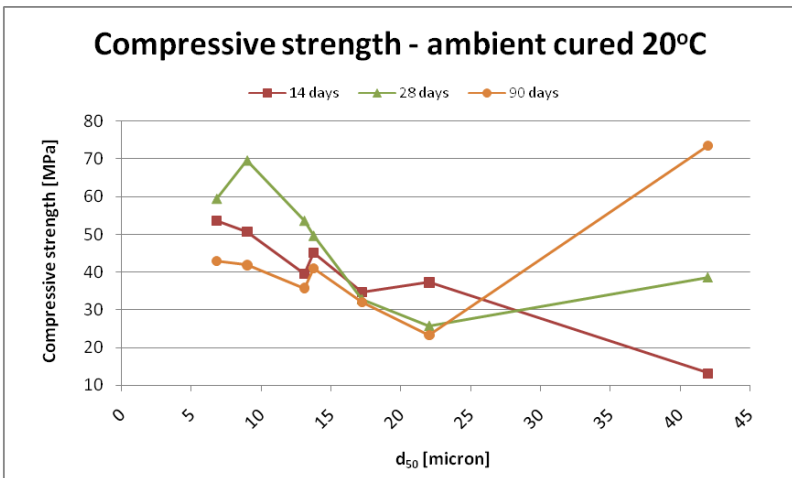
## Compressive strength of fly-ash pastes

Heat cured samples were measured after 7, 14 and 28 days. So prepared samples have approximately 80-90% value of their final strength characteristics after finish of heating. After 28 days is value of compressive strength constant. Ambient cured samples were measured after 14, 28 and 90 days. So prepared samples have after 28 days approximately 60% value of their final strength and after 90 days is value of compressive strength constant.



**Graph 2 Compressive strength of fly-ash mixtures with regards to sizeclass mean diameter of fly-ash – heat cured samples**

For compressive strength development in time is for ambient cured samples typical long time period to reach the final physical-mechanical characteristics. Therefore was measurement focused on compressive strengths after 14, 28 and 90 days, that it is possible consider as final value.

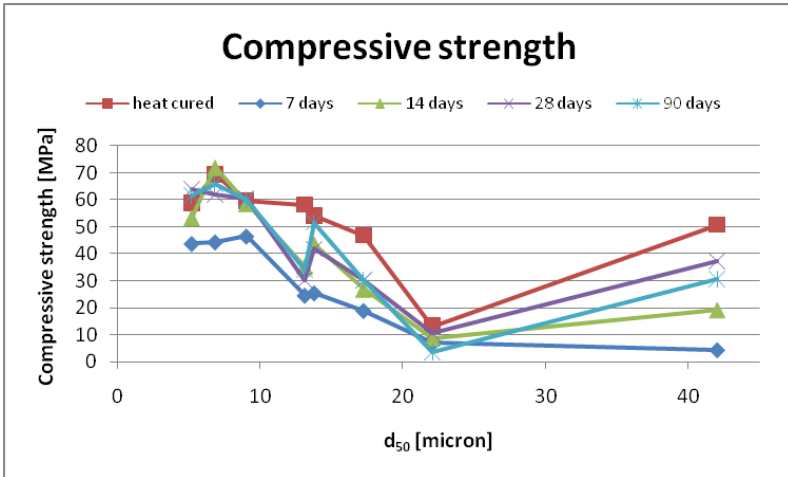


**Graph 3 Compressive strength of fly-ash mixtures with regards to sizeclass mean diameter of fly-ash – ambient cured samples**

## Concrete mixtures

Eight fly-ash concrete test series was prepared. The first one was prepared from non-grounded fly-ash and rest seven series were prepared from grounded fly-ash. Time of grinding was 15, 30, 45, 60, 120, 180 and 270 minutes).

## Compressive strength characteristics



**Graph 4 Compressive strength of fly-ash concrete mixtures with regards to sizeclass mean diameter of fly-ash**

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