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METHODS FOR ANALYSING DEPOSITS IN PORES USING COMPUTERTOMOGRAPHY

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Summary: To optimize the protection of concrete against cracks caused by alkali-silica-reaction it is important to understand the whole ASR-process in detail. We can show how to prepare the sample to save as much information about structure as possible. To get additional information about the process we use false-color to analyze the different density in different layers inside sedimation in pores.

1. INTRODUCTION

Since nearly 100 years on building and components made of concrete there are described special damage symptoms caused by alkali-silica-reaction (ASR). This reaction is a complex sequence of chemical and physical processes leading to cracks. Because of the complexity of the processes this phenomenon is very difficult to describe and understand in every single step. Traditionally samples with ASR-problems are analyzed by using microscopy and X-ray diffraction. These methods lead to high-resolution pictures but they also destroy the structure of the samples. To safe the structural information of the whole sample we used x-ray tomography as an imaging method instead of microscopy.

By using CT we were not only interested in information about the microstructure but also on additional information about the whole process leading to damage concrete.

2. EXPERIMENTAL METHOD

The experiments were performed using a GE “nanotom m”. This CT scanner belongs to the Bauhaus-Universität Weimar. To reconstruct the data “phoenix datoslx” was used. The volume data was analyzed and visualized by Volume Graphics VG Studio MAX 3.0.

To know where to find the interesting pores and to get important information about the whole structure, we started the experiments with a sample size of 6 cm. The size was reduced step by step to get the best compromise between getting a high resolution and losing to much information. The smallest sample size was as tiny as a pinhead. During the scanning process it was stuck on a glass rod. For the bigger samples hot glue was used, for the tiny ones nail polish worked better.

After getting the perfect sample size, we used false-color instead of grey-value pictures, to make it easier to analyze the structure and to bring out the different distribution of the density inside the mineral deposits.

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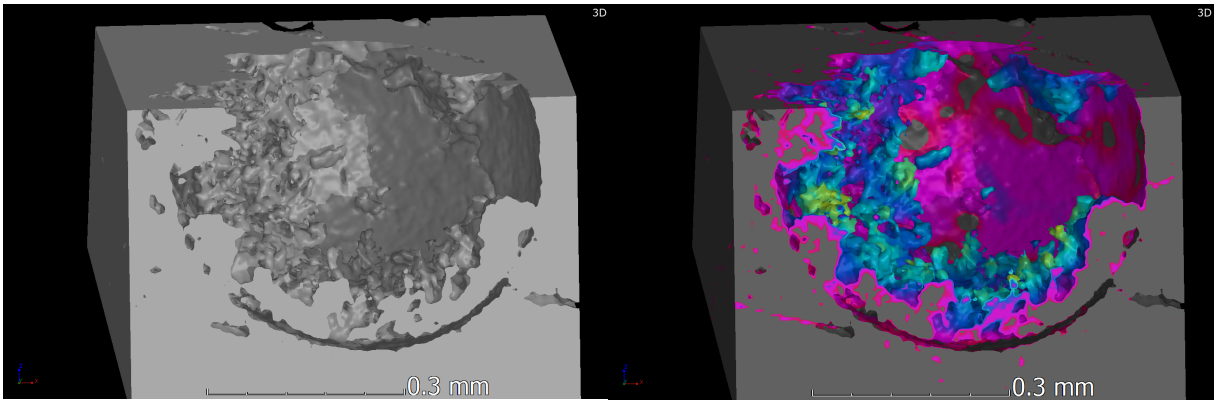
3. RESULTS

Stepwise reduction of the sample size allowed us to perfectly locate the interesting structures and to get a lot of information about the surrounding microstructure. The use of false-color helped minimizing misinterpretation of the results caused by visual illusion like interpreting different grey values as shadows instead of differences in density. The main result of applying false-color is the proof of the fact that ASR-gel consists of layers with different density. So now it is possible to describe the structure of the ASR and to understand the underlying processes better than before.
Besides this we can show, that the method is also a proper way to analyze other kind of deposit in pores without destroying the whole structure.



(a) (b)

Figure 1: (a) ASR-gel found in a piece of concrete
(b) Using false-color to visualize the internal structure of the ASR-gel