Characterization of initial and « second-stage » ASR products by SEM and TEM with EDX and SAED

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Alkali-Silica Reaction (ASR) happening in concrete structures is one of the main issues regarding concrete durability. Metastable silicates present in aggregates are dissolved by hydroxyl groups OH^- in the alkaline pore solution. The degrading silica structure then bonds mainly to water, calcium and alkali ions. Due to the water uptake, the reaction products expand, leading to stress in the aggregates and subsequent cracking.

The composition and structures of ASR products located in aggregates and cement paste can vary substantially (Sachlova et al. 2010, Gholizadeh Vayghan et al. 2016, Leemann et al. 2016). In a novel approach using SEM and TEM, (Boehm-Courjault & Leemann, 2017) two different stages in the product formation could be identified, namely initial and « second-stage » products. The small volume of initial ASR product makes its analysis with classical techniques difficult. « Second-stage » ASR product occurring in larger volume has been analyzed and characterized in several studies (Thaulow et al. 1996, Katayama et al. 2012, Leemann & Lura 2013, Leemann & Merz 2013, Dähn et al. 2016). Data on initial ASR are needed to improve our knowledge on ASR evolution. The aim of the project is to improve the understanding of initial product formation and its relation to the « second-stage » product. TEM analysis will be performed to assess the morphology and the chemical composition as analyzed by EDX. Selected Area Electron Diffraction (SAED) will provide information about the structure of the initial product.

Two sample types will be studied and compared to characterize ASR products : (1) concrete from a structure affected by ASR, and (2) laboratory concrete in accelerated conditions.

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