

An ESEM in-situ study on microstructural changes of polymer-modified mortars during water storage

Outdoors or within bathrooms, ceramic tile adhesives are exposed to humid and wet conditions. Intruding water can cause a number of microstructural changes, which may influence the physical properties of the mortar (e.g., strength and flexibility).

Dissolving and precipitation processes result in a secondary hydration of unreacted cement, and leaching mechanisms can lead to efflorescence phenomena on the grout. This study however, will focus on the behaviour of different polymer phases such as cellulose ether, polyvinyl alcohol and latices.

In-situ experiments using ESEM-FEG (Environmental Scanning Electron Microscope with Field Emission Gun) allow to observe micro-structural changes at the surface of a freshly broken piece of mortar before and after it was wetted and dried again by varying temperature and water vapor pressure in the sample chamber.

The micro-structural observations strongly confirm recent results gained from other experiments where polymer films were studied outside of the mortar (Jenni et al., this volume):

- i) During immersion, films of cellulose ether (CE) and polyvinyl alcohol (PVOH) dissolve in the water phase. After drying again new films are formed at other locations in the microstructure, which is clear evidence for the mobility of CE and PVOH during water storage.
- ii) Latex films, on the other hand, can be found after drying exact at the same locations where they occurred prior to the ESEM in-situ experiment.

An interesting finding was that PVOH, added as redispersion-aid to a redispersible powder, could be observed in the microstructure of the mortar as isolated non-structured films beside the latex films.

The microscopic observations support data from application tests of water-stored films and polymer-modified mortars. Thus, despite of the qualitative character of such an in-situ ESEM study the gained results make an important contribution to the understanding of the behavior of water stored polymer-modified mortars.

References:

Jenni, A., University of Bern, CH; Holzer, L., EMPA Dübendorf, CH, Zurbriggen, R., Elotex AG, CH: Filmbildung in zementären Systemen. (Film formation of polymers in cementitious systems.) GDCh-Tagung, Fachgruppe Bauchemie, Würzburg, Germany.