

Unique collaboration between Henkel and the University of Malaga towards eco-cement characterization at the ALBA Synchrotron

Working together, scientists from Henkel, ALBA and University of Malaga, using synchrotron-based high-resolution powder X-ray diffraction, have conducted a series of novel experiments to study in real time the setting behavior of new cement formulations.

● The work is an excellent example of a successful collaboration between industry (Henkel), academia (University of Malaga) and a research institution (ALBA), each making their own, unique contribution to the development of new, sustainable technology.

Henkel, under the brand Ceresit, has been in the cement business for over 100 years, ever since the introduction of first cementitious insulation mortar in 1910 (Fig. 19). In recent years, the focus in both construction and consumer cement applications is on eco-friendly technologies, with smaller carbon footprint and reduced CO₂ emissions.

The development of the new eco-cement formulation was performed by Henkel R&D in Dusseldorf, but for advanced real-time characterization the company chose to partner with an external research facility with the necessary expertise in the field of X-ray crystallography, since the knowledge of how crystal phases are developed in novel eco-cement formulation was critical for the performance of the product.

As luck (or perhaps good planning) would have it, the ALBA Synchrotron in Spain had recently commissioned a new MSPD X-ray beamline that was uniquely suited to conduct in-situ studies, thanks to a combination of wide-range,

high-energy X-ray beam (8 to 50 keV) and state-of-the-art X-ray detectors. This allowed acquisition of powder X-ray patterns both at high speed to monitor the changes in cement formulations, as well as with high resolution, producing high-quality data, suitable for quantitative analysis (Fig. 20). Thanks to good planning of ALBA staff, and especially the expertise of beamline scientists (Dr. François Fauth, Dr. Inma Peral), the experiments went without a hitch.

The Rietveld refinement, a complex mathematical process of quantitative analyzing X-ray diffraction data, also required a unique set of skills. Here, the expertise of the Head of the ALBA Experiments Division, Dr. Miguel Ángel García Aranda, and his connection with experts from the University of Malaga was leveraged to conduct detailed analysis of experimental data.

As a result of this collaboration, a clear picture of evolution of crystalline phases in cement formulation was obtained, at the extremely wide time scale (15 min – 3 months). But perhaps more importantly, the experience of scientists from Henkel, ALBA and University of Malaga working shoulder-to-shoulder has built a good foundation for future collaborations. This work serves as a good example of successful industry-academia-government partnerships.

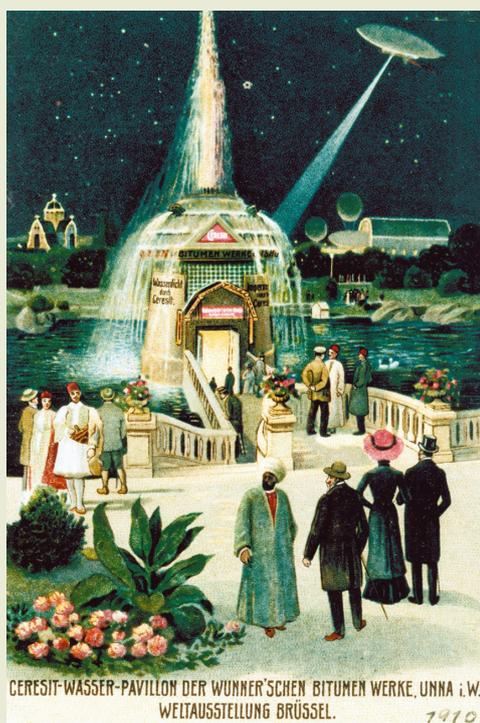


Figure 19: Advertising poster, showing Ceresit pavillion at 1910 World's Fair in Brussel. © Henkel

Figure 20: Experimental patterns from a cement formulation (top) and cement formulation with internal standard (bottom). © Henkel

