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IN SITU HYDRATION OF SULPHOALUMINATE CEMENT MIXTURES MONITORED BY SYNCHROTRON X-RAY DIFFRACTION

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The hydration of calcium sulpho-aluminate cement mixtures was studied in situ by synchrotron X-ray diffraction at the XRD1 beamline of the Laboratório Nacional de Luz Síncrotron (LNLS) in Campinas, SP. The powder specimens were introduced in borosilicate glass capillary tubes of 0.7 mm of internal diameter and imbued with deionized water. As the hydration reaction is very fast the capillaries were placed on the goniometer and the data collection was started after two minutes of mixing with water. The X-ray energy chosen to get an adequate flux for these short time acquisitions was 12 keV or more precisely 1.033258 Å, determined with polycrystalline corundum standard. Diffraction patterns were collected sequentially every 35 seconds for several hours at temperatures ranging from 40 degC to 55 degC with an accuracy better than 0.1 degC attained with the help of a hot air blower. The diffracted signal was collected with an array of twenty-four Mythen detectors at 760 mm from the capillary tube. The diffraction patterns had appropriate statistics to determine the kinetics of the reaction either by quantitative Rietveld analysis or by fitting isolated diffraction peaks to Gaussian curves as a function of time. The most important phases involved in the hydration are Klein´s salt, also known as Ye'elimite, Ca4(AlO2)6SO4, and gypsum, CaSO4.2H2O to yield Ettringite, Ca6Al2(SO4)3(OH)12·26H2O, phase responsible for the mechanical properties.