

QUANTITATIVE RIETVELD PHASE ANALYSIS OF HYDRATED PORTLAND CEMENTS: I. QUANTITATIVE ANALYSIS OF SYNTHETIC AF_m AND AF_t PHASES

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ABSTRACT

Ettringite ($C_3A \cdot 3CaSO_4 \cdot 32H_2O$), Monocarbonate ($C_3A \cdot CaCO_3 \cdot 11H_2O$), Monosulfate ($C_3A \cdot CaSO_4 \cdot 12H_2O$) and Portlandite $Ca(OH)_2$ are the main crystalline phases of hydrated Portland cements. X-ray diffraction pattern analysed by the Rietveld method enables quantitative determination of crystalline and amorphous phases contained in hydrated Portland cements.

Ettringite, Monocarbonate and Monosulfate were synthesised under CO_2 -free conditions. The X-ray pattern of this phases showed preferred orientation. To minimise the preferred orientation the samples were prepared with the side-loading technique. In the case of Monosulfate a paste sample has to be prepared to avoid preferred orientation. Standard data of Ettringite, Monocarbonate and Monosulfate were refined on basis of the X-ray pattern nearly free from preferred orientation.

Physical mixtures of defined amounts of this three phases were made to demonstrate the precision and reproducibility of the quantitative Rietveld analysis. Although the mixtures showed preferred orientation the Rietveld software was able to correct this effect by using the March Dollase function. Therefore it was possible to quantify such model mixtures with a precision of ± 3 wt.-%.