

Sample Holder

D2 PHASER

LYNXEYE

Application Report XRD 10

D2 PHASER Desktop XRD: Quantitative phase analysis of OPC Clinkers

The D2 PHASER is a portable desktop XRD instrument for research and quality control. It is easy to operate and independent of external media such as cooling circuits. Thanks to the LYNXEYE detector it is the fastest desktop XRD system on the market. The system delivers high quality measurement data, which allows performing advanced analytical methods, such as the standardless quantitative Rietveld phase analysis. This report demonstrates its use for the phase quantification of Ordinary Portland Cement Clinkers.

Tab. 1: Experimental settings.

D2 PHASER, LYNXEYE detector
Cu radiation (30 kV, 10 mA), Ni filter
Continuous scan from 10 to 65° 2Theta, Step width 0.02° Counting time 0.5 sec per step
Total scan time about 25 min.
2.5° Soller slits, 1.0 mm divergence slit, anti-scatter screen
LYNXEYE detector opening 5° 2Theta

X-ray powder diffraction combined with TOPAS Rietveld analysis is nowadays one of the most powerful methods existing, to perform quantitative phase analysis. In the last years it became a standard tool in cement industry for quality and process control, not only for clinker and cement analysis, but also for the whole process mineralogy.

A clinker sample of the 2005 VDZ Round Robin (German Cement Works Association) was analyzed, to demonstrate the performance of the D2 PHASER for such applications. The measurement covered the angular range from 10 to 65° 2Theta. The scan time was about 25 minutes. Experimental details are summarized in Table 1. Figure 1 shows the measured data as well as the results of the TOPAS Rietveld analysis.

The quantitative results compare well to the outcomes of the VDZ Round Robin (Figure 2). There is an excellent agreement of ±1 wt. % for the main phases, with respect to the mean values of all participants.

To conclude, our cost-effective desktop XRD system D2 PHASER, equipped with the 1-dimensional LYNXEYE detector, provides high quality data, which allows doing reliable quantitative phase analysis of Portland Cement Clinkers and related applications.

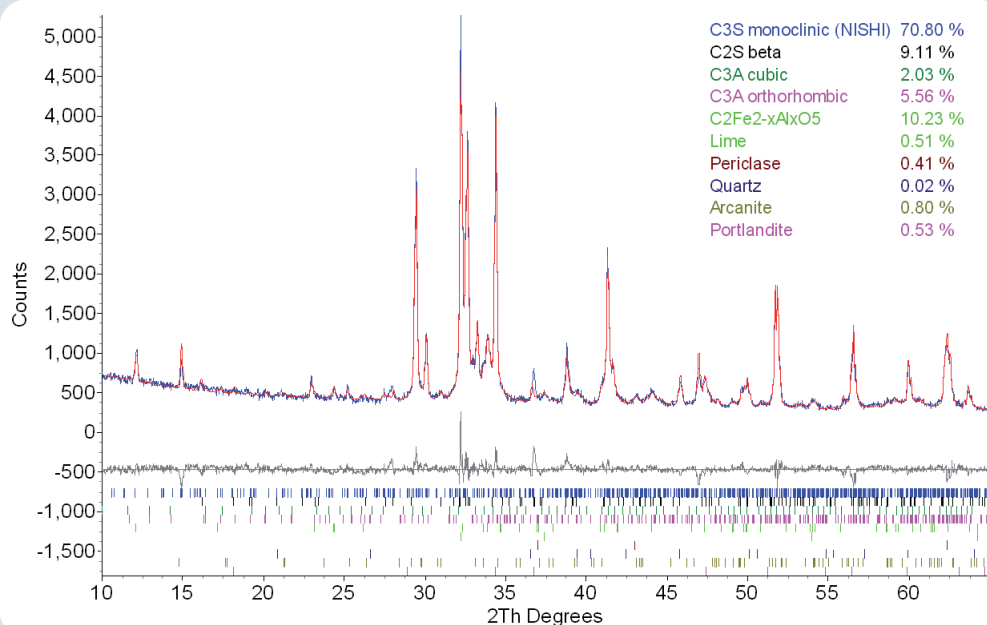


Figure 1: TOPAS Rietveld phase quantification of the VDZ Round Robin Clinker sample (values given in wt. %). The blue curve is the measured diagram. The red curve is the calculated diagram. In grey the difference of both is given. The marks below indicate the possible peak positions of each phase.

Results VDZ Round

phase	mean	esd
Alit (C ₃ S)	71,55	2,63
Belit (C ₂ S)	8,42	1,55
C ₃ A kubisch	1,89	0,76
C ₃ A orthorhombisch	5,32	1,08
Brownmillerit (C ₂ (A,F))	9,39	1,05
Freikalk (CaO)	1,21	0,49
Periklas (MgO)	0,71	0,22
Arcanit (K ₂ SO ₄)	1,52	0,34
Summe C ₃ A _{kub} + C ₃ A _{orth}	7,22	0,68

*in addition, we find Portlandite due to aging of the sample



Figure 2: Outcomes of the VDZ Round Robin 2005. Mean values and standard deviation are given in wt.%.

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