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**Experimental Report N° 56/23**

Page 1/2

Assignment: The influence of concrete admixture to sulfate resistance of mortars.

Product designation: Admixture for concrete,  
marked as **ConProtect SR (WP 1)**, quantity ~ 1 l (~ 1,2 kg).

Forwarded to the laboratory by manufacturer on 28.09.2022.

Test method:

**Reference and test mortars** were prepared in accordance with requirements of EN 196-1 and recommendations by the costumer. Portland Composite Cement CEM II/A-M 42,5R, Sulfate Resistant Portland Cement CEM I 42,5N-SR3 and CEN reference sand were used. Reference mortars were made without admixture, test mortars with **ConProtect SR (WP 1)** in quantity of 1 % of cement mass (determined by costumer).

For testing sulfate resistance of cements, Wittekindt' flat prisms method was used. Mortars were made with the same water-cement ratio 0.50 (EVS-EN 196-1). With every cement six so called Wittekindt' flat prisms (10 x 40 x 160) mm were made. After two weeks hardening in Ca(OH)<sub>2</sub> solution, the length of prisms was measured with special measuring device DIN 52450 "FORM+TEST" with accuracy of 0,001mm.

Three prisms were exposed into 4.4 % Na<sub>2</sub>SO<sub>4</sub> solution and as reference sample three prisms of the same mortar were storage in saturated Ca(OH)<sub>2</sub> solution at (20 ± 1) °C. The storage solutions were changed monthly. Relative expansion due to sulfate attack of prisms was measured after 14, 28, 42, 56 and 91 days of storage in 4.4 % Na<sub>2</sub>SO<sub>4</sub> solution and expressed as rate to expansion of prisms stored in saturated Ca(OH)<sub>2</sub> solution [ $\Delta\varepsilon = (l_{\text{Na}_2\text{SO}_4} - l_{\text{Ca(OH)}_2}) \times 1000 / 160 \text{ mm/m}$ ]. The results are given in Table 1.

In terms of used method, cements with relative expansion after 91 days of storage less than 0.50 mm/m are classified as sulfate resistant cements.

Test results:

Table 1: Relative expansion of cements, expressed as rate of expansion of prisms stored in the 4.4 % Na<sub>2</sub>SO<sub>4</sub> solution to expansion of prisms stored in the saturated Ca(OH)<sub>2</sub> solution

Solution	Expansion of (10 x 40 x 160) mm specimens in saturated Ca(OH) <sub>2</sub> , in 4.4% Na <sub>2</sub> SO <sub>4</sub> solution by Wittekindt method, and relative expansion Δε, mm/m									
	14 days		28 days		42 days		56 days		91 days	
	single	mean	single	mean	single	mean	single	mean	single	mean
<b>Reference mortar with CEM II/A-M (T-L) 42,5 R</b>										
4,4 % Na <sub>2</sub> SO <sub>4</sub>	0.106	0.100	0.219	0.219	0.381	0.388	0.488	0.496	0.894	0.890
	0.100		0.225		0.388		0.500		0.894	
	0.094		0.213		0.394		0.500		0.881	
Saturated Ca(OH) <sub>2</sub>	0.094	0.096	0.100	0.102	0.100	0.102	0.119	0.117	0.188	0.190
	0.094		0.100		0.106		0.113		0.181	
	0.100		0.106		0.100		0.119		0.200	
<b>Δε</b>	0.00		0.12		0.29		0.38		<b>0.70</b>	
<b>Test mortar with CEM II/A-M (T-L) 42,5 R and 1 % WP1</b>										
4,4 % Na <sub>2</sub> SO <sub>4</sub>	0.081	0.083	0.194	0.196	0.325	0.331	0.369	0.371	0.588	0.581
	0.088		0.200		0.338		0.375		0.588	
	0.081		0.194		0.331		0.369		0.569	
Saturated Ca(OH) <sub>2</sub>	0.081	0.079	0.088	0.090	0.094	0.096	0.094	0.100	0.100	0.106
	0.081		0.094		0.100		0.106		0.113	
	0.075		0.087		0.094		0.100		0.106	
<b>Δε</b>	0.00		0.11		0.24		0.27		<b>0.48</b>	
<b>Reference mortar with CEM I 42,5N- SR3</b>										
4,4 % Na <sub>2</sub> SO <sub>4</sub>	0.019	0.021	0.075	0.083	0.113	0.119	0.175	0.173	0.288	0.290
	0.025		0.088		0.125		0.175		0.300	
	0.019		0.088		0.119		0.169		0.281	
Saturated Ca(OH) <sub>2</sub>	0.013	0.017	0.019	0.023	0.025	0.033	0.031	0.042	0.031	0.044
	0.019		0.025		0.038		0.050		0.050	
	0.019		0.025		0.038		0.044		0.050	
<b>Δε</b>	0.00		0.06		0.09		0.13		<b>0.25</b>	
<b>Test mortar with CEM I 42,5N- SR3 and 1 % WP1</b>										
4,4 % Na <sub>2</sub> SO <sub>4</sub>	0.025	0.025	0.075	0.073	0.100	0.098	0.138	0.135	0.219	0.221
	0.025		0.075		0.100		0.138		0.225	
	0.025		0.069		0.094		0.131		0.219	
Saturated Ca(OH) <sub>2</sub>	0.025	0.023	0.025	0.027	0.025	0.027	0.031	0.029	0.031	0.033
	0.025		0.031		0.031		0.031		0.037	
	0.019		0.025		0.025		0.025		0.031	
<b>Δε</b>	0.00		0.05		0.07		0.11		<b>0.19</b>	

The test results are valid to the described test samples only.

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