SINTEF Byggforsk
SINTEF Building and Infrastructure
Address:
Postboks 4760 Sluppen
NO-7465 Trondheim
NORWAY

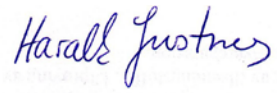
Telephone: +47 73593000
Telefax:+47 73597136

byggforsk@sintef.no
http://www.sintef.no/Byggforsk/
Enterprise /VAT No:
NO 948007029 MVA

Memo

Sorel cement

PERSON RESPONSIBLE / AUTHOR
Harald Justnes



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Sorel cement is a hydraulic cement, which was named after Stanislav Sorel who invented it in 1867. Hydraulic cement refers to any inorganic binder which cures in the reaction with water, even under water and in contact with rain, etc. The original Sorel cement was certainly previously known to not tolerate moisture very well after curing, with strength loss over time as result, but modern formulations with a bit of phosphate (approximately 1%) has improved this dramatically. While a cured Sorel cement paste (i.e. without aggregates) lost 94% of its original strength after 2 months in running water, it lost only 4-7% strength under the same conditions when less than 1% phosphate was added*.

A big difference between Sorel cement compared to Portland cement is that its pore water has a much lower pH (about 9-10 compared to 13-14) and also contains chlorides. In contrast to Portland cement, it should not be reinforced with ordinary steel that probably will begin to corrode relatively quickly. On the other hand, Sorel cement may very well be reinforced with glass fibres, which is limited for ordinary Portland cement since its high pH can break them down. This is well exploited in the Promat's products. Sorel cement can achieve very high strength and are used in everything from grinding stones to artificial ivory in snooker balls, as well as in larger building materials. A compressive strength of 70 MPa (N/mm^2) can be achieved for the pure paste (i.e. cement and water) after 14 days of curing in air *.

Some chemistry is needed to describe the bonding agent in the Sorel cement. Sorel cement is also called "magnesia cement" as the main ingredient is magnesia or magnesium oxide (MgO). The term "magnesium oxychloride" cement is also used as this refers to the binding crystal phases. Sorel cement can be obtained by mixing for instance 2.5 to 3.5 parts MgO to 1 part magnesium chloride ($MgCl_2$). When MgO powder is mixed with a solution of magnesium chloride, several different compounds in the same "family" will form needle-like crystals that represent the binding medium. This "family" of compounds consist all of three constituents; magnesium hydroxide, magnesium chloride, and crystal water, in different ratios. One often talk about 5-phase and 3-phase as the most common ones, and the number is simply the molar ratio between magnesium hydroxide and magnesium chloride in this "family" of compounds.

* D. Deng: "The mechanism for soluble phosphates two Improve the water resistance of magnesium oxychloride cement, Cement and Concrete Research, Vol 33, 2003, pp 1311-1317.