NO MAG-PHOS OUTGASSING

PERFORMANCE CHARACTERISTICS

Phoscrete MPC Concretes DO NOT OFFGAS!
Unlike older generation MAPC (Magnesium-Ammonia-Phosphate-Cement) concretes, Phoscrete's MPC (Magnesium-Phosphate-Cement) concretes do not contain ammonia and DO NOT OUTGAS. Therefore, sealants and coatings, including silicone, epoxy, methacrylate, and urethane bond well to Phoscrete.

Reaction mechanism of MgO with ammonium di-hydrogen phosphate in water versus with mono-aluminum phosphate solution or mono-potassium phosphate in water

In a water solution, ammonium di-hydrogen-phosphate dissociates and enters into a reaction with MgO. On mixing, an exothermic reaction takes place with some initial loss of ammonia.

MAPC: $NH_4H_2PO_4 + MgO + 5H_2O \rightarrow MgNH_4PO_4 \cdot 6H_2O$

The reaction leads to the formation of "Schertilite" **$Mg(NH_4)_2(HPO_4)_2 \times 4\ H_2O$** at first. However, in presence of water and depending on the quantity of water available in the matrix of the material, a further reaction occurs to the more stable mineral "Struvite**" $Mg\ NH_4\ PO_4 \times 6\ H_2O$**. Due to a change in the **Mg / NH_4** ratio from 1:2 to 1:1 during this reaction, it can be assumed that some "off gassing" takes place over time. As a result, there are two "offgassing" mechanisms that take place during the formation MAPC – first during the exothermic reaction and then during a curing period after setting[i].

In contrast, the reactions between magnesium oxide and either mono-aluminum phosphate (MALP) or mono-potassium phosphate (MKP) in solution can be described as follows:

MALP: $2MgO + Al(H_2PO_4)_3 = 2\ MgHPO_4 \times 3H_2O + AlPO_4 \times H_2O$
MKP: $MgO + KH_2PO_4 \rightarrow MgKPO_4 + H_2O$

The above stoichiometric reaction only happens in excess of MgO. This means in presence of water also this reaction is not totally in equilibrium and more MgO gets consumed over time during curing. Tests have shown that the final MALP product results in "Newberite" **$2MgHPO_4 \times 3H_2O$**[ii] and the final MKP product results in "K-struvite" **$MgKPO_4 + H_2O$**[iii]

Therefore, "outgassing" after setting does not occur in MALP and MKP types of acid base cements.

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[i] Soudée, E & Péra, J. (2000). Mechanism of Setting Reaction in Magnesia-Phosphate Cements. Cement and Concrete Research. 30. 315-321. 10.1016/S0008-8846(99)00254-9.

[ii] *T. Finch, J.H. Sharp. "Journal of Material Science" 24 (1989) 4379 - 4386*

[iii] Lothenbach, Barbara & Xu, Biwan & Winnefeld, Frank. (2019). Thermodynamic data for magnesium (potassium) phosphates. Applied Geochemistry. 111. 104450. 10.1016/j.apgeochem.2019.104450.