

**CRYSTAL FIELD CONCEPT  
IMPLEMENTATION IN MATERIAL  
SCIENCES: SOME COLOURED CASES  
FROM CEMENT AND CONCRETE  
INDUSTRY**

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Crystal field concept is a fruitful approach in crystal-chemistry and geosciences [1, 2] can also be fruitful in Material sciences, focused on transition elements speciation and site localisation by mean of optical absorption spectra.

In cement and concrete materials, grey by nature, some remarkable colouring effects can occur from blue to green. In Alite ( $\text{Ca}_3\text{SiO}_5$ ), main component of Portland Cement Clinker, incorporation of Cr can lead to an intense blue colour [3]. Such intense blue dots have been recognized in Portland cement clinker nodules [4] showing a colour closed to blue diopside ( $\text{CaMg}[\text{Si}_2\text{O}_6]: \text{Cr}$ ), well known in experimental petrology. Similar electronic spectra lead to conflicting interpretations involving  ${}^{\text{IV}}\text{Cr}^{3+}(\text{LS})$  or  $\text{Cr}^{4+}$ [5, 6] but in any case, this colouration can be seen as a coloured indicator of the cooling history of the sample. This colouring feature was observed in Portland cement clinker as long as chromium has not been quantitatively limited to 2ppm.

Cement is not the sole construction material to exhibit strange colour, even concrete can do! Under anoxic conditions of curing, ground granulated blast furnace slag based cement concretes show a transient blue- green colour which involves polysulfide radicals [7]. Still in Portland cement clinker, Brownmillerite supposed to be dark brown, may show a dark green colour by mean of Mg substitution.

More traditional is the role of Fe in Ye'Elimite [ $\text{Ca}_4\text{Al}_6(\text{SO}_4)\text{O}_{12}$ ] whose reactivity is connected to hydraulic reactivity [8]

[1] Burns, 1970b, Cambridge University press, [2] Langer and Andrut, 1996, Geochem Soc., Spec Pub. N°5, [3] Johansen, CCR, 2, 1972; [4] L. Izoret, Vicat internal report, 1992; [5] Ikeda and Yagi, Contrib. Mineral. Petrol., 61, 1977; [6] L. Izoret, PhD 1985. [7] Lecornec et al., CCC, 2017; [8] Bullherjan, F, PhD, 2018.