

TECHNICAL INFORMATION

CHROMIUM (VI) IN CEMENT AND ITS SIGNIFICANCE

21 Scandium Sc 44.956	22 Titanium Ti 47.867	23 Vanadium V 50.942	24 Chromium Cr 51.996	25 Manganese Mn 54.938	26 Iron Fe 55.8457
39 Yttrium Y 88.906	40 Zirconium Zr 91.224	41 Niobium Nb 92.906	42 Molybdenum Mo 95.94	43 Technetium Tc (98)	44 Ruthenium Ru

BACKGROUND

Chromium is found in small quantities in many natural materials including the raw materials used to make cement. It is found in many different forms but specifically as Chromium (III) which is insoluble and Chromium (VI) (or 'Hexavalent Chromium') which is soluble.

The concerns around the presence of Chromium (VI) in cement, centre on its impact on the health of people using it.

Chromium (VI) is a strong sensitizing agent for allergic contact dermatitis (also called chromate allergy and chromate eczema). Some workers who come into direct and repeated contact with wet cement/mortar/grout/concrete (e.g. masons, grouters and some general construction workers) can be susceptible to developing an allergic reaction.

Chromate allergy usually develops slowly over many years (typically 10 to 20 yrs) but can result in chronic skin irritation, ulceration, scarring and occupational disability. Cobalt is implicated as a co-sensitizer and cement's abrasiveness and high pH/alkalinity either initiates and/or exacerbates the allergic condition.

The insoluble Chromium (III) is not implicated in these problems.

LEGISLATION

Concerned about the problem of chromate allergy in Europe, the European Parliament wished to reduce the incidence of allergic dermatitis throughout Europe (It should be noted that the problem is not restricted to users of cement, but is found in a wide range of occupations such as metal finishing. The use of safety gloves where the leather tanning process involved chromium containing materials was also a major cause).

Part of this process involved limiting the amount of soluble chromium (Chromium (VI) or 'Hexavalent' Chromium) in cement to a very low value: 0.0002% (2 ppm) by dry weight of cement at the point that the cement is hydrated (i.e. when water is added).

The Commission issued a Directive in 2003 [2003/53/EC] in order to put the wishes of the Parliament into effect.

The Directive was later incorporated into the REACH Regulation [Regulation EC 1907/2006: Annex 47] and as such is part of UK Health and Safety legislation.

This legislation also applies to 'cement containing preparations' such as mortar, concrete or specialist cementitious products.



IMPLICATIONS FOR CEMENT

Whilst some cements, such as white Portland cement, do not contain Chromium (VI) as a result of the nature of their raw materials, many sources of cement do. This means there is a need to treat the cement in order to keep the soluble chromium below the 2 ppm regulatory limit.

The most widespread means for achieving this is by the addition of small quantities of a chemical called a 'Reducing Agent' to the cement. When water is added to the cement, this reducing agent converts most of the soluble Chromium (VI) to insoluble Chromium (III). Sufficient reducing agent is added to ensure that any residual soluble chromium is below the 2 ppm limit. Typical reducing agents include; ferrous sulfate, tin sulfate and tin chloride.

Unfortunately, the efficiency of the reducing agent reduces with time if it is exposed to air and/or moisture, which can permeate through packaging or storage silos. This gives rise to the need for a declared 'Shelf Life' for cement.

The cement Shelf Life is the period of time for which the cement producer guarantees that the cement will release less than 2 ppm Chromium (VI) by weight of cement, when water is added to it, assuming it has been stored correctly. The length of this shelf life will vary, depending on a number of factors including; the overall Chromium (VI) content of the cement, the type and addition rate of the reducing agent and the type of packaging/storage (e.g. Silos, paper bags or plastic bags).

As an example, cement packed in paper will generally always have a shorter shelf life than the same cement packed in plastic as the rate of degradation of the reducing agent by air permeating through the bag is higher.

Information on the appropriate storage conditions for cement and its shelf life must be marked on the packaging (for packed cement) and/or on the delivery ticket (for bulk cement).

Cement that has exceeded its shelf life should not be used.

IMPLICATIONS FOR USERS OF CEMENT

Irrespective of the use of reducing agents in cement, users should still wear proper PPE.

When cement is used to produce other products, the user should check that it is still within the declared shelf life and also check that the product does not contain other sources of Chromium (VI) that could increase the overall level of Chromium (VI) above the 2 ppm limit.

For concrete, and cement based mortar / renders / screeds, once the material has hardened there is no further risk of allergic dermatitis.

For formulated cement- containing products, where a blend of ingredients is used, the manufacturer or formulator is responsible for ensuring that the material (when hydrated) does not contain more than the 2 ppm limit on Chromium (VI) and also for declaring the shelf life.

FOR FURTHER INFORMATION

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