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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 21371-2019

Replacing GB/T 21371-2008

By-product gypsum used in cement

用于水泥中的工业副产石膏

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1 Scope

China's national standard for the industrial by-product gypsum used in cement. It specifies the terms and definitions, the classification, the technical requirements, the test methods, the inspection rules and the storage and transport of by-product gypsum used as a cement addition. Every Portland cement contains gypsum, in a few per cent, and without it the cement would be useless: the tricalcium aluminate in the clinker reacts with water within minutes, and gypsum is what retards that reaction so the concrete remains workable long enough to place. Natural gypsum has always supplied it, but industry produces enormous quantities as a by-product - desulfurisation gypsum from the flue gas scrubbers of coal-fired power stations, phosphogypsum from phosphoric acid manufacture, and the gypsums from citric acid, fluoride and titanium dioxide production - and using them displaces quarrying and disposes of a waste in the same operation. The difficulty is that a by-product is not a controlled product. It carries whatever the process it came from left in it: phosphogypsum carries residual phosphate and fluoride, both of which interfere with cement setting far more strongly than their quantity suggests; desulfurisation gypsum carries chloride and unreacted sulfite and arrives very wet; several carry organic matter or heavy metals. So the standard classifies by source and sets the requirements that matter for cement use: the attapulgite-free sulfur trioxide and the crystalline water that establish how much gypsum is actually present, the moisture, and the limits on the specific impurities each source brings - with the radioactivity requirement that phosphogypsum in particular requires. Issued on 18 October 2019 and in force since 1 September 2020, it replaces GB/T 21371-2008.

This Standard specifies the terms and definitions, technical requirements, test methods and judgment rules, transportation and storage of industrial by-product gypsum used in cement. This Standard is applicable to the acceptance and use of industrial by-product gypsum for adjusting the setting time of cement.

2 Normative References

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this document.

GB/T 1346 Standard Test Method for Water Requirement for Normal Consistency Setting Time and Soundness of the Portland Cement

GB/T 2419 Test Method for Fluidity of Cement Mortar GB/T 5483 Natural Gypsum

GB/T 5484 Methods for Chemical Analysis of Gypsum

GB 6566 Limit for Radionuclides in Building Materials

GB/T 17671 Test Method of Cement Mortar Strength (ISO Method) JC/T 1083 Test Method for Compatibility of Cement and Water-Reducing Agent

3 Terms and Definitions

For the purposes of this Document, the following terms and definitions apply.

3.1 By-product gypsum The general term for by-products with calcium sulfate as the main component that are discharged from industrial manufacturing. NOTE 1: Also known as chemical gypsum, synthetic gypsum. S - mass fraction of SO₃, expressed by percentage (%); w - mass fraction of crystal water, expressed by percentage (%).

5.3 Radioactive material limits It shall be tested according to GB 6566.

5.4 Influence of industrial by-product gypsum on cement properties

5.4.1 Preparation of contrast cement It is the P·I Portland cement, which is prepared by the Category-G and Class-2 above (including Class-2) gypsum specified in GB/T 5483, with SO₃ content of 2.0%~2.5%, 80µm sieve residue of less than 4%, and specific surface area of 350m²/kg±10m²/kg.

5.4.2 Preparation of test cement It is P·I Portland cement that is prepared by using Portland cement clinker for preparing contrast cement and by replacing natural gypsum with 30%~100% of the assessed industrial by-product gypsum. During the preparation, the 80µm sieve residue of the cement shall be controlled to less than 4%, the specific surface area shall be within the range of 350m²/kg ± 10m²/kg, and the difference between the SO₃ content and the contrast cement SO₃ content shall be within 0.2%.

5.4.3 Standard consistency water consumption, setting time and stability of cement It shall be tested according to GB/T 1346.

5.4.4 Fluidity of cement mortar The preparation of cement mortar is carried out according to GB/T 17671; and the fluidity test operation of cement mortar is carried out according to GB/T 2419.

5.4.5 Strength of cement mortar It shall be tested according to GB/T 17671.

5.4.6 Compatibility of cement and water-reducing agent It shall be tested according to JC/T 1083.

6 Judgment Rules

When any one of 4.1, 4.3, 4.4,