Application of Catalyst and Additive in Grouting Reinforced Material

According to ***the supplementary safety technical requirements for reactive polymer materials in coal mines (Trial)*** formulated by the national safety standard center in 2020, the national emergency management department has issued the industry safety standard AQ/T1089-2020 ***Polymer Materials for Coal Mine Reinforcement of Coal and Rock Mass***, which has been implemented since May1, 2021. The standard not only reduces the maximum reaction temperature of polyurethane organic and inorganic coal rock reinforcement materials from ≤ 140 ℃ in the old safety standard to ≤ 100 ℃, but also makes strict requirements on the reaction stability of materials during storage. This poses an unprecedented technical challenge to the reinforcement material manufacturers. As we all know, the catalyst plays an important role in the exothermic process of polyurethane curing reaction. The stability of the catalyst basically determines the stability of the material in the storage cycle. Therefore, the correct selection of the catalyst is the key breakthrough to solve the above technical problems. Guangzhou Yourun has developed a special catalyst for the new safety standard in view of the compatibility and uniform stability of inorganic reinforcement material, the controllable maximum reaction temperature and storage stability of organic reinforcement material, which solves the problems of incompatibility of inorganic reinforcement material DMAEE, intense catalytic heat release of organic reinforcement material T-12, activity attenuation during storage, low promotion of foaming strength, etc, which provide stable and reliable product and technical support for enterprises producing reinforcement materials under the industry

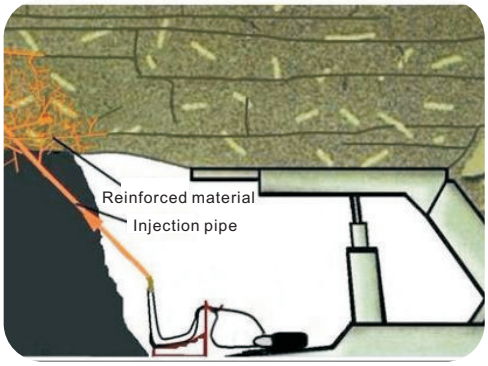
1. Organic Grouting Reinforced Material

Recommended Products:

Product Name	Model	Property
Catalyst	AUCAT-MK02	Low reaction heat release and no failure
	AUCAT-MK02A	Catalyst for the latter stage with low reaction exothermic and fast curing
	AUCAT-MK11	Balanced typed of non foaming catalyst with mild heat release and fast curing
Defoamer	YRXP-02	Good compatibility, efficient foam inhibition and breaking function.

It is developed for the new safety standard of organic reinforced AB material to solve the problems of exceeding the maximum reaction exothermic temperature, slow curing and reduced strength in storage. The specific characteristics are as follows:

- Reduce the maximum reaction temperature of AB material mixture and improve the safety of underground coal mine. The reasonable combination of MK02 and MK02A can make the heat release of catalytic reaction gentle and solve the problem that the maximum reaction temperature exceeds the standard caused by the exothermic concentration of organic tin (T-12).
- Improve the storage stability of AB material. After long-term storage, the curing time is stable and the strength does not decrease. Eliminate the potential safety hazards caused by the slowing down of curing and reduction of strength, which is due to the non failure of MK02 / MK02A oxidation resistance and hydrolysis resistance; While the addition of organic tin catalyst into material A will gradually lead to oxidative hydrolysis failure, resulting in slow curing, reduced strength or even no curing, which has certain potential safety hazards.
- It has bubble-free characteristics and higher strength. The strength of the cured material is higher than that of organic tin, which is due to the fact that MK02 / MK02A does not catalyze the reaction between trace water and isocyanate, so as to avoid CO2 bubbles. While organic tin strongly catalyzes the reaction between trace water and isocyanate, which will cause severe exothermic foaming, resulting in strength reduction.
- After curing, AB material has better toughness and bears higher coal and rock deformation. MK02 does not promote the cross-linking side reaction of isocyanate, and allows more linear polyether diols to be used for material A. The material has higher toughness after curing, bears greater deformation, and the bonding strength is increased; The combination of MK02A and MK02 can coordinate and promote the reaction between NCO and OH, accelerate the later forming of materials, and ensure the rapid forming of reinforcement materials in the later stage under the condition of slowing down the exothermic reaction in the earlier
- Environmental protection, very low volatility, no tin element, almost no harm to human body and environment. Environmental protection complies with the EU children's toy standard EN71-3 2019, while organic tin, especially T-12, is well known for its toxicity and environmental hazards, whose application has been restricted in many fields.



2. Inorganic Grouting Reinforced Material

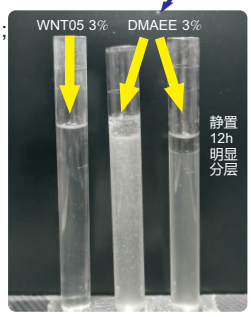
Recommended Products:

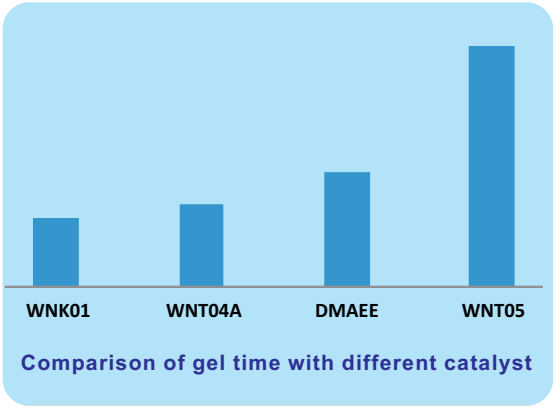
Product Name	Model	Property
Catalyst	CUCAT-WN	Compatibility suitable for low modulus Sodium Silicate
	CUCAT-WNT04A	High activity, fast curing
	CUCAT-WNT05	Good compatibility, no layering
	CUCAT-WNK01	High activity, suitable for spraying on vertical surface.
Dispersing Agent	YRXR-04A	Improve the compatibility of Sodium Silicate with other raw materials.

CUCAT-WN series catalysts are used for inorganic grouting leaking stoppage materials with the following characteristics:

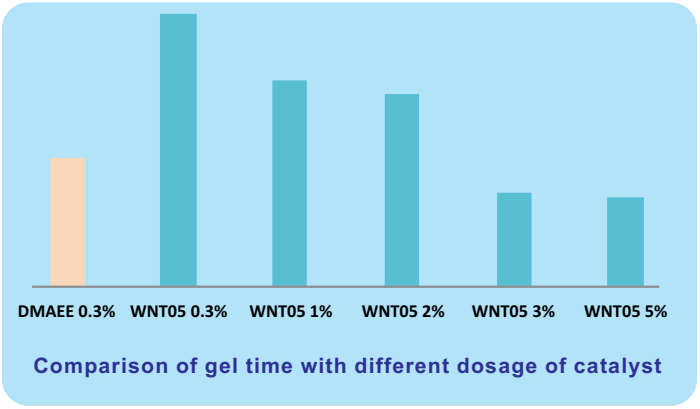
- less odor, clean and friendly production environment. Compared with other catalysts, it reduces olfactory stimulation to construction personnel in closed environment.
- Stable without failure. The catalytic activity of general catalysts in strongly alkaline sodium silicate decreases with time, and the structure of CUCAT-WNT is stable and the attenuation is not obvious.
- The cured composite has high strength. The strength of inorganic reinforcement after curing is directly related to the reaction product and reaction completeness, which depends on the catalyst used. CUCAT-WN series has higher strength than other catalysts after curing.
- WNT04A and WNK01 have high catalytic activity and the addition is low.
  - I. The activity of WNT04A catalyst is about 1.3-1.5 times that of DMAEE;
  - ii. The catalytic activity of WNK01 is about twice that of DMAEE (see the figure below). It is recommended for the application of vertical surface spraying which need rapid solidification. It can be rapidly solidified and formed in 3-8 seconds.
- CUCAT-WNT05 has good compatibility with sodium silicate. Sodium silicate belongs to high-density water-soluble inorganic matter. Generally, the catalyst is mixed with it and is turbid and insoluble.

DMAEE cause obvious stratification in12 hour





Comparison of gel time with different catalyst



Comparison of gel time with different dosage of catalyst