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Experimental Study on Superfine Grind Process for the Preparation of Calcium Carbonate Particles via Vibrated Mill

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Abstract

To obtain the minimum particle size calcium carbonate, the vibrated mill was used to grind analytically pure calcium carbonate. This experimental method was introduced to research what effect grinding time, grinding media size and filling rate have on grinding in order to select the optimal operation condition. The results showed that the vibrated mill could grind analytically pure calcium carbonate with size of about 1.5 μ m, and with the grinding time increased, the size of the particles decreased. However, its size remained even reversed when decreased to a certain degree. The optimum technological condition is a parameter combination including 10mm diameter grinding ball, 65% filling rate and 500g powder quality.

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Keyword: Calcium carbonate; superfine grind; vibrated mill

1. Introduction

The special quantum size effect, small size effect and surface effect of super-fine calcium carbonate make it have distinct advantage over conventional powder material on corroborative mess, transparency, dispensability, levelling property and so on^[1-2]. China began to pay attention to the study of super-fine calcium carbonate since 1980s, although several different types of super-fine calcium carbonate product have been developing and producing,

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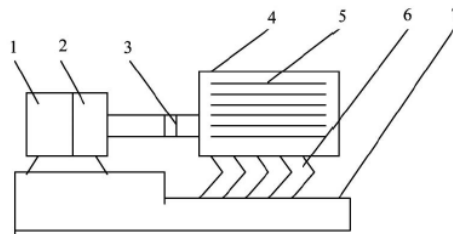
Problems that exist in our calcium carbonate product, such as less varieties, low yield, backward manufacturing technique and equipment, obliging us to import high grade product. Therefore, how to take full advantage of our abundant limestone mine resource and develop the super-fine calcium carbonate is of great significance for domestic papermaking, plastic, rubber industry and so on.^[3-4]

With the development of material industry, superfine grinding has quickly become a new technology recently, which can keep ordinary material ultrafine without changing its chemical constitution but surface and interfacial properties to achieve the super normal result. Vibrated mill is a kind of mechanical powder equipment used to produce material fines and ultra fines, whose outstanding merits such as simple structure, small size, light weight, low energy consumption, high production efficiency, small plate medium erosion, absence of disperse and so forth give it a significant advantage in the field of superfine grinding, moreover, it is widely applied in the fields of non-metallic ore grinding, beneficiation, metallurgy, Chemicals, medicine, building materials, food, etc.

This article used experimental vibrated mill to do experimental study on ultrafine grinding of analytically pure (AR) calcium carbonate powder, and will compare the test results between different size grinding media and filling rate for acquiring better technological conditions.

2. Testing apparatus

This experiment used experimental vibrated mill to ultrafine grind calcium carbonate particles, and had got good results^[5]. The experimental vibrated mill is shown in Fig.1



1.Electric motor 2.Coupling 3.Centrifugal exciter 4.Grinding barrel 5.Grinding media 6.Support reed 7.Pedestal

Fig.1 Structure chart of experimental vibrated mill

The operating principle of the vibrated mill is first to put material and grinding media into grinding barrel supported by spring, then electric motor actuates centrifugal exciter by flexible coupling to generate exciting force which drives grinding barrel to produce high frequency vibration, making material and grinding media in the barrel produce cast, impact, shear, friction, rotary motion, thereby the material can get grinded. The grinding media built-in the grinding barrel can be of rod or ball with different sizes. The grinding media in the grinding barrel could be round or oval with different size. Centrifugal exciter was installed on the main shaft while working amplitude of the vibrated mill was adjusted by exciter.

3. Kinetic equation for vibration grinding system

In order to facilitate analysis, vibrated mill system was simplified into vibrating system with two degrees of freedom variable mass, as shown in Fig.2.

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