Three types of superfine powder

Superfine particles can be divided into three grades which are large, medium and small superfine particles.

Large superfine particle has the grain size in the range of 100A-1000A; medium superfine particle has the grain size in the range of 20A-100A; small superfine particle has the grain size below 20A. Currently it is still difficult to produce the medium and small superfine particles. Therefore, the superfine powder materials described in this section refer to the solid particle that has the grain size in the range of 0.1μm-0.01μm. It can be seen that the superfine particle we describe is a kind of middle material state that ranges between bulk material and atoms or the molecules and is composed by small amount of atoms or molecules that are obtained artificially, which keeps the chemical property of the original material. However, the atoms or molecules groups which are in metastable state are unstable in thermodynamics. Therefore, it is the key to understand how the microcosmos can be transited to the macrocosm by researching and developing the superfine materials. With the high development of electron microscope, the existence, size and shape of superfine particles can be observed very clearly.

Compared with its general powder, some unique properties of superfine particle have been found, for example, it has low melting point, high chemical activity, strong magnetic, good heat conduction, anomalous absorption to electromagnetic wave and other specialties. The changes of these properties are mainly caused by “surface effect” and “volume effect”. Although some specialties and applications of superfine particles are remained to be further researched and developed, the above unique properties have opened a bright future for its wide applications.

The thinner the superfine particle grain size, the more obvious of its melting point depression. The melting point of silver bullion is 900 degrees Celsius, while the melting point of its superfine particle can be declined to less than 100 degrees Celsius and it is soluble in hot water. The melting point of gold bullion is 1064 degrees Celsius, while the melting point of the superfine particle that has the grain size of 20A is only 327 degrees Celsius. Due to the lowering of melting point, **metal powders**, alloy powders or compound powders can be sintered under low temperature and produce various mechanical parts, which can not only save energy consumption and reduce the manufacturing process difficulty, but also can obtain the assembly units that have excellent performances. For example, when the high melting point materials such as WC, SiC, BN and Si3N4 are used as the structural materials, their manufacturing process need to be conducted under high temperature sintering, while by using the superfine particles, these manufacturing process can be conducted under very low temperature and can obtain high density sintered body without the additives. This can be a very good practical significance for the high performance of inorganic structural materials in opening up more and wider applications. The superfine particle which has smaller diameter will have bigger total specific surface area as well as increase its surface energy and have higher chemical activity. Thus it can be used as the high-performance catalyst in chemical reactions and perfect combustion catalyzer in the ballistite. The existing practice shows that the catalysts made by the superfine particles which are mainly composed by Ni and Cu-Zn alloys have 10 times of the efficiency than traditional catalysts in the organic hydrogenation; in the ballistite, the burning calories of the fuel per gram can be doubled by adding less than 1 percent weight of superfine particles **aluminum powders** or **nickel powders**.

Due to the strong magnetic of superfine particle, it can be used in the magnetic materials. By using γ-Fe203, Cr02 and

metal superfine particles, high density magnetic tapes and video tapes that have better performances have been developed, which have 10 times of the density packing than the former ones and also have good stability. Now more of its application ranges are being opened up, such as the new type colloidal liquid magnetic material, mechanical seal, loudspeakers and other aspects.

The metals and their powders which are often seen by us will reflect the light and appear to be metal luster. However, the superfine particles of the metals will lose their luster completely. Besides, the thinner of its particles, the deeper the black it will be, which may be caused by the full absorption of light wave. Due to this feature of superfine particle, it can not only be used as the light absorption materials in solar energy utilization, but also be used as the coating of hotline detectors. Besides, the thin film which is made by adding iron trioxide that has superfine particles and zinc stearate dispersant into the polystyrene resin will have good permeability to light and good absorptivity to ultravilolet light. If the thin film is added into the plastics, transparent plastic container that is resistant to ultravilolet light can be obtained, which has better transparency than the amber glass. If it is added into the food package, it can protect the food from being affected by the ultravilolet light and effectively extend the freshness.

The superfine particle is being used in catalyzing, low temperature sintering, composites, new functional materials, tunneling, medicine, bioengineering and other fields and has achieved very exciting results. The research of superfine particles is generally considered to be started in 1962. In fact, the comprehensive research and development of superfine particles were started in the 1980s. As a whole, this project is still in the initial study stage and many technique and theory problems are subjected to be further discussed. It is not surprising that scientists expect that the superfine

particles will become novel functional materials in 21st century.