Silica and Alumina Spherical Fine Particles

1. Introduction

For the first time in the world, Micron Co., Ltd. has successfully developed technology for manufacturing spherical fine particles on an industrial basis using a flame spraying method. Now the company manufactures and sells spherical ceramic fine particles of silica, and alumina, among others. At present, fillers for semiconductor encapsulation materials represent the major application of spherical fine particles. Micron is pressing ahead with product development to meet the needs of packaging technology for a greater degree of IC integration, and the company's products are highly rated by its customers. Since Micron's spherical fine particles have high packing density and high flowability, so they are expected to be employed for various new applications other than semiconductor materials.

2. Manufacturing Process and Features of Spherical Fine Particles

Manufacturing process

- A thermal spraying process using flames is employed to manufacture Micron's spherical fine particles.
- By selecting suitable raw materials and setting the optimum spraying conditions, it is possible to implement highly accurate particle size control for widely varying particle diameters.
  < Raw material → thermal spraying → classification → particle size adjustment → product >

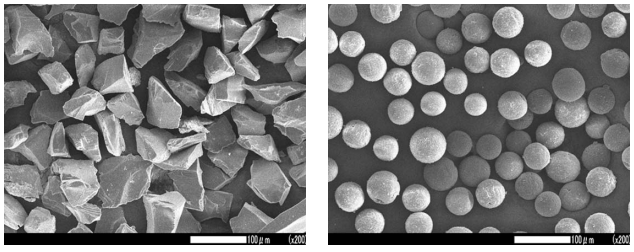
Features

- The particles offers high sphericity (high roundness) (see **Photo 1**).
- The particles offers high flowability and high packing density.
- The particles offers good wear resistance.

3 Spherical Fine Particles of Silica

Micron's fine particles of silica – spherical in shape and offering the properties desired of silica (low thermal expansion, high electrical insulation, low moisture absorption, etc.) – has many different purposes in diverse fields, including various types of resins as fillers for semiconductor encapsulation materials, and fillers for molding materials and paints.

As a filler for semiconductor encapsulation materials, in particular, demand for spherical silica fillers continues to increase because they meet the needs for smaller, thinner packages with higher performance and reliability and for effective environmental measures. Micron offers various types of products that meet those needs (see **Table 1** and **Fig. 1**).



a) Anguler filler **b) Spherical filler**

Photo 1 SEM image of the angular filler and the spherical filler

Table 1 Silica products line-up

Name	S110	S311	S520	SP10
d50 (μm)	20	25	30	2.5
Sa (m^2/g)	1.7	2.6	1.6	8.0
Roundness	0.885	0.930	0.950	0.970

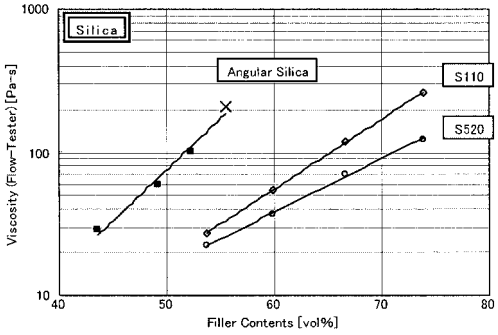


Fig. 1 Difference of fill-ability to epoxy by the filler shape

4. Spherical Fine Particles of Alumina

Micron's fine particles of alumina – spherical in shape and offering the properties desired of alumina (high thermal conductivity, good heat resistance, high electrical insulation, high hardness, etc.) – has many different purposes in diverse fields, including various types of resins as fillers for thermal conductive sheets, fillers for molding materials, base powder for baking ceramics, blasting materials and spacers.

As a filler for thermal conductive sheets, in particular, alumina is very popular since it is comparatively inexpensive and offers high thermal conductivity. Because of the spherical nature of these powder particles, it is possible to easily enhance the packing density of the filler. In addition, by controlling the particle size distribution with a combination of two or more types of spherical alumina, it is possible to improve the thermal conductivity of the filler (see **Table 2** and **Fig. 2**).

Table 2 Alumina products line-up

Name	AW70-125	AW50-74	AX-116	AX-118
d50 (μm)	64-70	50-56	18-24	14-20
Cut point	125 μm	75 μm	32 μm	25 μm
Name	AX35-125	AX10-32	AX3-32	AX1-15H
d50 (μm)	30-40	7-13	2.5-4.5	1.0-1.4
Cut point	125 μm	32 μm	32 μm	15 μm

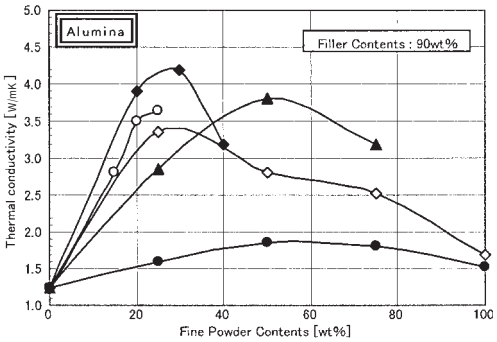


Fig. 2 Thermal-conductivity 50 μ m-sphere by fine powders

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