

# Technical Information

## IS06



## Special Glasses for the Dental Industry

### Glass Fillers for Composites

Dental fillings literally are on the tip of everyone's tongue. In former times, defects were filled with amalgam, alternatively also with silica cement or unfilled polymerisable resins. Each of these materials provided some advantages, but unfortunately some severe disadvantages as well.

Although amalgam (an alloy consisting mainly of silver and mercury) was persistent and cost-effective, it had the disadvantage of the toxicity of mercury, combined with an unaesthetic dark color. Silica cement did not have this dark color, but disintegrated much faster and had a poor resistance. The unfilled resins, that were introduced in the 1950s had an aesthetic appearance, but also lacked resistance for fillings of molar teeth to withstand the high biting forces. They could only be used for front teeth. Additionally, the volume contraction of the resins was a problem, because fissures and thus possibilities for secondary caries attack could be formed.

The introduction of composites in the 1970s resulted in improved surface hardness, highly aesthetic appearance, lesser shrinkage and good wear resistance. Over the years, the properties of the composites were further improved.

The grain size of the glasses plays a decisive role for mechanical strength and causes the filling to be polishable like a tooth. There are other important properties that absolutely need to be fulfilled by a dental glass, such as roentgen opacity for detection of the filling in standard X-ray photographs.

In modern composites, the medium particle size of the glass fillers ranges from 0.4 to 3.0  $\mu\text{m}$ . Often a mixture of several grain-size fractions is used to get optimal loads and processing properties.

### Special Glasses from Ferro

Ferro's Industrial Specialities business unit is known for its high-quality, innovative products.

Our R&D and Applied Technology department constantly works on improving our products and providing maximum benefit for our customers.

As a leading supplier of special glasses, Ferro offers worldwide service. New developments are made in our own pilot plant in Germany.

The production, technical advice and development of the ultrafine dental glasses are located in our site in Frankfurt a.M. which is certified according to DIN ISO 9001 and OHSAS 18001.

Besides the special glasses mentioned in table 1, we also offer color stains which were especially designed for the use in dental ceramics. For details, please refer to our information leaflet IS02, „Pigments for the Dental Industry“ or contact us.

### **Properties of the Dental Glasses**

Our special glasses are fused homogeneously. They show only very little variations in their respective refraction index. The glasses are inert, i.e. they do not react with the other components of the composite mixture.

The glass compositions have been chosen to match the refraction index of the common dental resins. In the moment, inert glasses for composite fillers with refraction indexes from 1.52 to 1.6 are available.

The portfolio comprises fluoride containing glasses as well as one glass without fluoride. The available products are listed in table 1. Table 2 summarizes the physical properties and the composition.

Barium causes the desired roentgen opacity.

A high-quality glass production contributes to the high purity of our glasses. The contamination with cadmium for example is lower than 10 ppm.

Fine milling is done to the desired medium particle size  $D_{50}$ . Typical grain sizes for coarser glasses are 5.0  $\mu\text{m}$ , 3.0  $\mu\text{m}$  and 1.5  $\mu\text{m}$ , for finer glasses 1.0  $\mu\text{m}$ , 0.7  $\mu\text{m}$  and 0.4  $\mu\text{m}$ .

The availability of ultrafine glasses up to 0.4  $\mu\text{m}$  ensures that the finished filling can be excellently pol-

ished and also results in a high filler load and high transparency of the composite.

Intermediate milling grades are possible if desired.

### **Quality Control**

In cooperation with the dental industry, Ferro has developed a comprehensive quality control for dental glasses. Tested are, among others, the particle size distribution, specific surface area, loss on ignition, heavy metal content (Pb, As, Sb, Cd), glass composition, fluoride content, transparency and color.

Exact control of the glass composition ensures constant chemical and physical properties.

### **Technical Support**

Our technical service supports you in the sampling and pilot phase.

If your desired product is not included in this brochure, please contact us. Our technical service team is looking forward to support you in finding a solution.

Table 1: Available Products

Product	Glass	Particle Size $D_{50}$ [ $\mu\text{m}$ ]
IS 50 1101 Dental Glass 0,4	A	0.4
IS 50 1102 Dental Glass 0,4	D	0.4
IS 50 1103 Dental Glass 0,4	F	0.4
IS 50 1101 Dental Glass 0,7	A	0.7
IS 50 1102 Dental Glass 0,7	D	0.7
IS 50 1103 Dental Glass 0,7	F	0.7
IS 50 1101 Dental Glass 1,0	A	1.0
IS 50 1102 Dental Glass 1,0	D	1.0
IS 50 1103 Dental Glass 1,0	F	1.0
IS 50 1101 Dental Glass 1,2	A	1.2
IS 50 1102 Dental Glass 1,2	D	1.2
IS 50 1103 Dental Glass 1,2	F	1.2
IS 50 1101 Dental Glass 1,5	A	1.5
IS 50 1102 Dental Glass 1,5	D	1.5
IS 50 1103 Dental Glass 1,5	F	1.5
IS 50 1101 Dental Glass 3.0	A	3.0
IS 50 1102 Dental Glass 3.0	D	3.0
IS 50 1103 Dental Glass 3.0	F	3.0
IS 50 1103 Dental Glass 5.0	F	5.0

Table 2: Glass Composition and Properties

Component	Glass A	Glass D	Glass F
	Ba Al B Si	Ba Al B Si F	Ba Al B Si F
BaO	22 - 42	22 - 42	22 - 42
SiO <sub>2</sub>	45 - 55	45 - 55	45 - 55
B <sub>2</sub> O <sub>3</sub>	~ 10	~ 10	~ 10
Al <sub>2</sub> O <sub>3</sub>	~ 10	~ 10	~ 10
F	-	~ 2	~ 2
Refraction Index	1.53	1.52	1.53

**Limitation of Warranty and Liability**

Ferro believes that the information contained in this document is accurate at the time of its publication. Ferro makes no warranty with respect to the information contained in this document. The information in this document is not a product specification, either in whole or in part. Your use of the information contained in this document and your purchase and use of this Ferro product are at your sole discretion. Downstream users are responsible for determination of the suitability of this product and for testing in specific applications. Nothing in this document shall be construed as a license for use that infringes upon any property rights of any third party. Please refer to the Safety Data Sheet (SDS) for safe use, handling and disposal information. All sales by Ferro to you are subject to Ferro's Terms and Conditions of Sale, as amended from time to time and available at [www.ferro.com](http://www.ferro.com). In the event this document conflicts with Ferro's Terms and Conditions of Sale, Ferro's Terms and Conditions of Sale shall control.