

# FR-998 Ceramic Material Specifications

## DESCRIPTION

FR-998 is a 99.8% pure, high fired density, advanced alumina ceramic containing less than 300 ppm silica and 200 ppm soda. It is ideal for applications in which excellent surface finish, RF properties, and superior chemical corrosion resistance is required. It offers fluorine plasma resistance, high dielectric strength, high compressive strength, and excellent hardness for resisting fluid cavitation and fretting wear damage. Low soda levels enable the use of FR-998 in most advanced semiconductor equipment applications, and it can be accurately green machined prior to sintering to produce cost-effective near net shape components ranging from 5 cm to 78 cm in diameter, with cross sections up to 8 cm thick.

## FEATURES AND HIGHLIGHTS

- Excellent resistance to Hydrofluoric, Nitric, and Hydrochloric acids
- Low soda content meets most semiconductor 99.8% Alumina specifications
- Highly resistant to Plasma Fluorine damage
- High volume resistivity and high dielectric strength
- Extremely low silica content, low porosity, and fine grain size enables superior fluid cavitation resistance
- Fine grain size and stability enables superior polishing with flatness of 1 micron over 33 cm diameter
- Near net shape processing reduces costs for making large sized components

## APPLICATIONS INCLUDE

- Semiconductor chamber components
- Gas discharge excimer and CO2 laser chamber components
- Submersible pumps and sensors
- Ceramic devices used for accurate fluid metering (sliding blood valves)
- Fluid bearings for pressurized seawater applications
- High voltage electrical insulation
- High pressure fluid energy applications
- Abrasive fluid flow control applications

## PROPERTIES

| FR-998                     | Test                   |        |
|----------------------------|------------------------|--------|
| <b>Physical Properties</b> |                        |        |
| Color                      | Visual                 | Ivory  |
| Density g/cm3              | ASTM C373-88, ASTM C20 | 3.93   |
| Average Grain Size Microns | ASTM E112-10           | 5 to 7 |
| Chrystalline Phase % Alpha | XRD                    | 100    |
| Water Absorption %         | ASTM C373-88           | 0%     |
| Hardness (GPA)             | ASTM C1327 Vickers     | 1650   |
| Impurities (SiO2 ) PPM     | GDMS                   | <300   |
| Impurities (Na2O) PPM      | GDMS                   | <200   |
| Impurities (CaO) PPM       | GDMS                   | <300   |
| Impurities (K2O) PPM       | GDMS                   | <100   |
| Impurities (Fe2O3) PPM     | GDMS                   | <250   |
| Impurities (TiO2) PPM      | GDMS                   | <100   |
| Impurities (C) PPM         | GDMS                   | <30    |
| Impurities (S) PPM         | GDMS                   | <30    |

## FRALOCK CAPABILITIES

- Alumina diameter up to 31" diameter part size
- Alumina thickness up to 3" (disk shape) or 12" height (cylinder shape)
- Green to fire Alumina and green-to-fire tolerances +/- 1.0%
- Hard grind to tolerances within 0.00002" (0.000508mm)
- Surface metallization
- Plating, lapping, dicing and brazing
- Pre-fired CNC machining tolerances +/- 1%
- Post fired dicing to +/- .001"