INOFLON™

Granular Polytetrafluoroethylene (PTFE) Free Flow Resin

INOFLON™220

Description

INOFLON™220 is a white powder (see Table I) with fairly uniform large particles and excellent flow. It has an average particle size of 800 μm. The unique characteristics of this resin are its high bulk density, low mould shrinkage and excellent flow which make INOFLON™220 an ideal candidate for automatic and isostatic moulding. Good powder flow is required for equipment with automatic feeding system, shallow mould cavities and for filling intricate mould spaces that are pressed isostatically. Very high flow of INOFLON™220 permits processing of a large number of preforms in a relatively short period of time using automatic moulding technique thus enhancing the productivity. High bulk density of INOFLON™220 allows larger mouldings to be made in a given mould or press opening (daylight).

When correctly processed, products fabricated from INOFLON™220 exhibit the superior properties that we have come to expect of Polytetrafluoroethylene resins. The parts retain useful properties at service temperatures in the range of -240°C to (-400°F) to +260°C (+500°F) such as chemical inertness to almost every industrial chemical and solvent, low friction and non-stick surfaces. Moulded articles are moderately stiff and possess tensile properties that meet requirements of many application including small parts like seals, gaskets, lab utensils, expansion bellows, piston rings etc. This resin is not suitable for compounding with fillers. Other grades such as INOFLON™630 and 640 are available for filled compounds. Higher bulk density and powder flow of INOFLON™220 extends the capabilities of INOFLON™210. Parts can be made at lower moulding pressure using INOFLON™220. This powder is particularly useful in automatic moulding of small parts where a smooth finish surface is required.

Parts made from INOFLON™220 resist ignition when exposed to fire and do not spread flame. These parts generate a small amount of heat and smoke when ignited by an external flame source. Please note that theses remarks are not intended to predict the hazards of burning of PTFE in an actual fire.

Typical End Use Products

Many end products are fabricated by moulding INOFLON™220 and machining of shapes. Examples include small parts such as seals, discs, ball valve seats etc. It is also used for moulding lined pipes, valves and fittings and for stock shapes to be machined for a broad range of applications. Large diameter rods and tubing can be made from INOFLON™220 which is then machined into parts such as mechanical bushings, electrical insulators and seal rings.

FDA Compliance

When products made from INOFLON™220 are correctly processed, that is sintered at high temperatures as practiced by the industry; they may comply with FDA Regulation 21 CFR 177.1550 for use in contact with food.

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Processing

INOFLON™220 is processed using automatic, isostatic and compression moulding methods. A two-step process is used to fabricate parts from INOFLON™220. Before using, the powder must be conditioned above 19°C (66°F). First the mould is filled with the resin. Next, it is compacted into a preform that has a shape similar to the final shape of the desired moulding. The preform is then sintered in an oven where it undergoes heating and cooling cycles, in which heating and cooling rates and dwell times are defined and programmed. The two cycles together are commonly called *sintering cycle*. The preform is heated to a temperature above the crystalline melting point of the resin during the sintering cycle. The cooling cycle is used To control the crystallinity of the part. The properties of a part are functions of preforming pressure, dwell time, sintering time and temperature and the cooling rate. INOFLON™220 is also processed by ram extrusion, in which preforming and sintering steps are combined in a continuous operation. Large diameter rods and tubing are fabricated by feeding successive charges of powder down a cylindrical heated die using a defined temperature profile.

Table 1- Typical Properties of INOFLON™220

Properties	Test Method	Unit	Nominal Value
Bulk Density	ASTM D 4894	g/l	825
Avg. Particle Size	ASTM D 4894	µm	800
Mould Shrinkage	ASTM D 4894	%	3
Std. Specific Gravity	ASTM D 4894	-	2.15 - 2.17
Melting Point Initial	ASTM D 4894	°C (°F)	342 (648)
Melting Point Second		°C (°F)	327 (621)
Powder Flow	Modified ASTM D 1855	g/min	600
Tensile Strength	ASTM D 4894	Mpa (Psi)	21(3050)
Elongation	ASTM D 4894	%	230

Note: These are typical properties and are not to be used for specification purposes.

Safety Precautions

Handling and processing of PTFE must be done in ventilated areas to prevent personnel exposure to the fumes liberated during sintering and heating of the resin. Fumes should not be inhaled and eye and skin contact must be avoided. Incase of skin contact, wash with soap & water immediately. Incase of eye contact, flush with water immediately and seek medical help. Smoking tobacco or cigarettes contaminated with PTFE may result in a flu-like condition including chills, fever and sore throat that may not occur until a few hours after exposure has taken place. This symptom usually passes within about 24 hours. Vapors and gases generated by PTFE during sintering must be completely removed from the factory areas. Mixtures of some metal powders such as magnesium or aluminum are flammable and explosive under some conditions. Please read the Material Safety Data Sheet and the detailed information in the "*Guide to the Safe Handling of Fluoropolymer Resins*" published by the Fluoropolymer Division of The Society of the Plastics Industry available at www.fluoropolymers.org.

Handling and Storage

Preforming at temperatures in the range of 23-28°C (73-82° F) is most preferable. Resin temperature must be above 19°C (66°F) during moulding because of a special molecular transition of PTFE at 19°C (66°F). PTFE molecule, which has a helical shape, tightens up by transition from a helix where 15 carbons are required for 180° turn to 13 carbons. Below 19°C (66°F), PTFE molecule becomes stiff and less conformable, thus there is a chance that moulded parts could end up cracked. PTFE powder becomes sticky, forms lumps and loses all flow at temperatures above 28°C (82°F).

For best results, the powder processing areas should be kept clean and free of all contamination. Organic contamination and foreign matter usually appear as dark spots often easily visible against the white PTFE background. Organic contamination material degrades at the sintering temperatures and forms discolored spots. They oxidize away as carbon dioxide wherever sufficient oxygen exposure takes place. It is, therefore, not unusual to encounter discoloration inside a part away from the surface where hardly any oxygen is present.

Packaging

INOFLON™220 is packed in plastic or fiber drums or corrugated boxes. Inside of this, resin is filled in double liner bags & closed with a plastic tie.