Xometry

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PF Bakelite

Description

Bakelite was the first plastic ever commercialized for industrial production. Its chemical name is phenol-formaldehyde plastic, commonly abbreviated as PF in English.

Features

It has high mechanical strength, excellent electrical insulation, and good heat and corrosion resistance, making it commonly used in electrical components such as switches, lamp holders, headphones, telephone casings, and instrument housings. This is how it got the name "Bakelite" (literally "electrical wood").

Parameters

1. Physical parameters: Relative density 1.3–2.0 g/cm³ (wood flour-filled: 1.35–1.4 g/cm³, mineral powder-filled: 1.9–2.0 g/cm³), mold shrinkage 0.5%–1.0%, water absorption ≤50 mg, typically available in powder or granular form with finished products in opaque dark brown or black (some lighter colors possible), refractive index 1.61–1.66, and hardness 3 (tougher and stronger than celluloid).

2. Mechanical parameters: Tensile strength 21–70 MPa (unfilled: 28–70 MPa, wood flour-filled: 35–56 MPa); flexural strength 56–84 MPa (some high-performance grades can reach above 78 MPa); compressive strength 70–245 MPa; shear strength 28–105 MPa; notched impact strength 1.3–6.0 kJ/m² (unnotched impact strength ≥6.0 kJ/m²); coefficient of linear expansion (3~8) $\times 10^{-5} K^{-1}$ (varies with filler type).

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3. Thermal parameters: Operating temperature range -30 to 180°C (typically 100–160°C); heat deflection temperature (HDT) ≥120°C (some grades can reach above 156°C or 165°C); molding temperature 150–170°C; thermal decomposition temperature ≥250°C; flame retardant rating UL 94 V-0 (most grades); no distinct melting point (characteristic of thermosetting plastics).

4. Electrical parameters: Dielectric strength 3.5–12 kV/mm (≥3.5 MV/m at 90°C); volume resistivity 10^{8}–10^{14} Ω·cm (typically ≥10^{10} Ω·cm); dielectric constant 2–6; dissipation factor (1 MHz) ≤0.08; good arc resistance, meeting the long-term usage requirements for electrical insulation components.

5. Other parameters: Flowability 80–180 mm; free ammonia content ≤0.02% (for ammonia-free grades); Chemical resistance: resistant to weak acids, weak alkalis, and most organic solvents; not resistant to strong acids or strong alkalis; processing methods: compression molding, injection molding, lamination, extrusion, etc., with compression molding being the primary method.