PSU (Polysulfone)

General information

Overview

Best considered as a group of materials similar to aromatic polycarbonates but which are able to withstand more rigorous conditions of use. Due to their higher price, they are usually only considered when PC or other cheaper polymers are unsuitable. In many fields of use they have replaced ceramics, metals, and thermosets rather than other thermoplastics.

Strengths

Resistant to high energy radiation. High degree of transparency. Higher service temperatures than for common engineering plastics (e.g. PC), self-extinguishing. Exceptional resistance to creep, generally good electrical insulation properties (though tracking resistance is not so good - as with other aromatics). Excellent sterilizability (radiation, steam, and ethylene oxide).

Limitations

Susceptible to stress cracking. Poor UV resistance (helped by carbon black pigmentation). Lower impact strength compared with PC, generally tough but notch sensitive.

Designation

Polyarylsulfones (PAS) is the family name. Polysulfones (PSU, PSUL) - this specific material. Polyether sulfone (PES) and polyaryl ether sulfone / polyphenyl sulfone (PAES, PPSU) are close relations.

Tradenames

Dicomp, Ensifone, Eviva, Gafone, Lasulf, Mindel, Starglas, Sustatec, Tecason, Udel, Ultrason-S, Vampson

Typical uses

45% of production is for electronics and 25% for end user products with 10% for medical applications. PCBs, capacitor film, engine bay components, sterilizable medical components, textile rollers for use where cast nylons are not sufficient, hairdryer, oven, microwave, and iron components, used for high clarity windows in product cases - e.g. dental floss, medical components, food processing equipment, electronics, valve bodies, under-bonnet components, housings.

Composition overview

Compositional summary

(C6H4-SO2-C6H4-O-C6H4-C(CH3)2-C6H4-O)n

Material family	Plastic (thermoplastic, amorphous)
Base material	PSU (Polysulfone)
CAS number	25135-51-7

Effect of composition

PES show higher Tg values with better creep resistance at elevated temperatures but show higher water absorption and density than other polysulfones. Higher molecular weight polysulfones show somewhat greater resistance to stress cracking, have better long-term strength under load and can have better impact strength.

Processing properties

First commercial production	1965

Forming

Standard thermoplastic processing methods. Most commonly injection molding. Pre-drying necessary for 3-6 hr at 150-260 °C (300-500 °F). High melt viscosity necessitates high melt and mold temperatures (former above 340-390 °C (645-735 °F)). Without such high temperatures, susceptibility for stress cracking increases. Blow-molding, extrusion, rotational molding, and vacuum-forming possible.

Machining

Very easy to machine

Joining

Very easy to bond, e.g. with DCM, providing bond strengths up to 60% of the bulk. Adhesives such as epoxies, polyurethanes, and phenolics can be used. Very suitable for friction and ultrasonic welding. Difficult to hot gas weld, impossible to radio freq. weld. Hot plate welding possible. At elevated temperatures, tensile properties of welds can deteriorate more quickly than those of the bulk material. Some grades can be laser welded. Self-tapping screws can be used.

Surface treatment

Very suitable for painting. Very suitable for metal plating/electroplating.

Geo-economic data for principal component

Annual world production	2.26e4	-	3.64e4	ton/yr