

Ultrason® — The Material of Choice for Membranes (Filtration)

Helping Make Products Better™



Ultrason® provides excellent product performance due to its outstanding qualities

- Outstanding mechanical properties between -50°C and 220°C (it outperforms most other commercially available thermoplastics between 150°C and 220°C)
- High dimensional stability with
 - a low co-efficient of thermal expansion (CTE)
 - no warpage, owing to the absence of crystallization
 - low creep, even at high temperatures
- Excellent long-term heat aging properties (RTI, UL 746B at 155°C and 180°C, PSU and PESU respectively)
- Short-term temperature resistance up to 180° and 220°C respectively
- Excellent chemical resistance (e.g. to water, acids, bases, fuel, oil, grease, fluorine, NaOCl solution, even at high temperatures)
- Can be used over a wide pH range (0-13) (PESU is superior to PSU in terms of temperature resistance and extreme pH values)
- Repeated sterilization possible with superheated steam at 121°C or 134°C, (ethylene oxide, radiation)
- Transparent (if compact) with low tendency to pick up color from food ingredients
- Complies with FDA and European standards for food contact (repeated use)
- Good pore size control
- Soluble in solvents commonly used for membrane production

Ultrason® – Key Characteristics

Property	Unit	Ultrason® S (PSU)		Ultrason® E (PESU)	
		3010	6010	2020 P	6020 P
Grade		3010	6010	2020 P	6020 P
Product form		pellets		porous flakes	
General					
Mass Density	g/cm3	1.24		1.37	
Moisture absorption 23 °C, 50% r.h.	%	0.3		0.8	
Surface tension (contact angle, water)		77°		80°	
Mean molecular weights					
Viscosity number	ml/g	72	81	56	81.5
Mw (light scattering in NMP)	g/mol	37- 45.000	45-55.000	27- 37.000	46 - 55.000
Dispersity Mw/Mn (GPC in DMF)		3.0-4.0	4.0 - 5.0	2.5 - 3.0	3.0 - 4.0
Thermal					
Glass transition temperature	°C	187		225	

Overview

Ultrason® E and Ultrason® S are superior to most other polymers in terms of their mechanical properties as well as their temperature and chemical resistance. They can be used as raw materials in the production of high-flux and low-flux membranes and even in areas of application where a short-term temperature resistance of up to 180/220°C is required (e.g. separation processes in the chemical industry). Both products comply with FDA and European regulations for food contact applications (repeated use).

Ultrason® S has already found wide acceptance as a base polymer in the membrane industry, while Ultrason® E 6020 P is also gaining ground and attracting more attention thanks to its superior hydrophilic properties, better temperature resistance (since its Tg is 40°C higher) and superior mechanical

properties. This renders Ultrason® E (PESU) very suitable for technical membranes, especially in aqueous systems, requiring not only high water permeability but also long lifetime, low fouling and excellent resistance to chemicals (cleaners, disinfectants, etc.).

Ultrason® E is soluble in NMP, DMAc and DMF, and is used in the entire range of membrane applications, from particle filtration (wastewater treatment) to microfiltration (clarification of beverages such as wine) to ultra-filtration (bacteriological and virological decontamination of drinking water) and reverse osmosis (seawater desalination). It is resistant to superheated steam, radiation or ethylene oxide sterilization and also exhibits, for example, good resistance to sodium hypochlorite, even at elevated temperatures.

Enhanced Features

Whereas Ultrason® E (PESU) is characterized by an inherently low quantity of oligomers, polysulfone (PSU) tends to contain somewhat higher concentrations of these (mainly cyclic) components. Especially the cyclic dimer due to its tendency to form crystals in the spinning solution causes problems in the membrane spinning process.

Ultrason® S products 3010, 6010 are optimized in this respect and have a low cyclic oligomer content, as a result of which they improve the following:

- The spinning or casting solution stability (reduced maintenance costs of the spinning facility)
- The stability of the membrane production process
- The defect rate on the membrane surface



Luvitec® K — The Material of Choice for Membranes (Filtration)

Helping Make Products Better™



BASF Advantage

BASF is the only one stop shop in the world that can provide complete raw material solutions for your membrane manufacturing world-wide

- base polymer **Ultrason® S (PSU), Ultrason® (PESU)**
(all membrane grades are global grades)
- modifier **Luvitec® K (PVP)**
(all membrane grades are global grades)
- processing solvents **NMP, Pyrrolidone, DMF, DMAc, Butyrolactone**

Polyvinylpyrrolidone (PVP) is widely employed in the membrane manufacturing process to better control the pore structure and to enhance hydrophilic properties of the membrane surface. BASF offers a broad range of PVP products under the brand name Luvitec® in order to meet specific viscosity and molecular weight requirements. In combination with Luvitec®, Ultrason® yields membranes having excellent chemical and temperature stability as well as

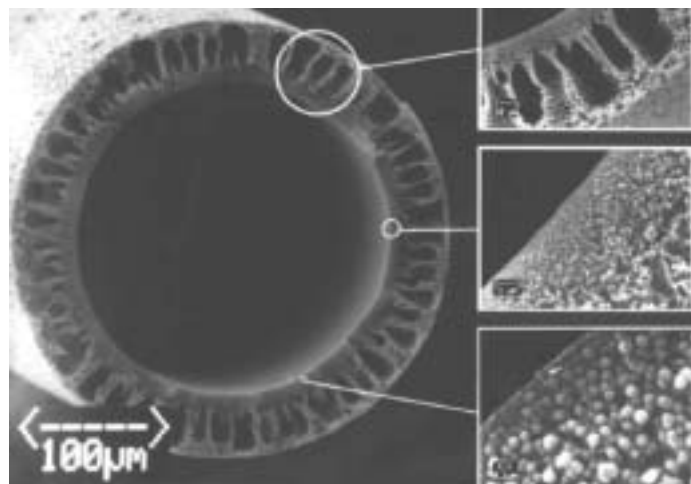
- higher porosity and permeability,
- better control of pore size and pore distribution
- highly interconnected pores,
- improved hydrophilic properties of the surface and less fouling

thus leading to a superior separation performance compared to systems without Luvitec® as an additive. Straight Ultrason® solutions display

Newtonian behavior over a wide range of concentrations, temperatures and shear rates. However, PSU/PVP and PESU/PVP mixtures exhibit greater viscosity and enhanced viscoelastic properties, which indicates strong interactions between the polymers.

An additional modification of the membrane is possible by cross-linking the PVP by means of temperature, UV-radiation, radiation, peroxide or E-beam.

BASF can supply manufacturers from a single source, offering Ultrason®, Luvitec® and many of the commonly employed solvents, as a complete membrane package, including full technical support.



Luvitec® – Key Properties

Property	Luvitec® Polyvinylpyrrolidone			
	K 17	K 30	K 85	K 90
K-value	15.0-19.0	27.0-33.0	84.0-88.0	88.0- 92.0
pH value	3.0-7.0	3.0-7.0	5.0-9.0	5.0- 9.0
Solids content, %	95.0-100.0	95.0-100.0	95.0-100.0	95.0-100.0
NVP monomer content, ppm	< 100	< 100	< 100	< 100

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