

TDS PIEZOTECH[®] RT-TS

For Printed Organic Electronics,
Smart Textiles and Plastronics



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I. General Properties

Piezotech® RT-TS, P(VDF-TrFE-CTFE) terpolymer, is a unique printable fluorinated electroactive polymer with relaxor ferroelectric properties.

I.1 Dielectric properties

Piezotech® RT-TS displays high dielectric constant (up to 60), high dielectric strength (> 350 V.μm⁻¹), high induced polarization and low remnant polarization.

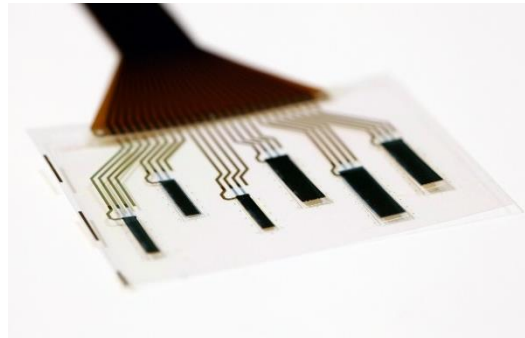


Figure 1. Printed actuators using Piezotech® RT-TS

I.2 Electromechanical properties

Piezotech® RT-TS shows high electrostrictive properties. Films based on these polymers can exhibit electromechanical deformation above 5% combined with high elastic modulus (up to 300 MPa) and high breakdown voltage. These materials are suited for the development of thin, light and flexible actuators and electrocaloric devices.

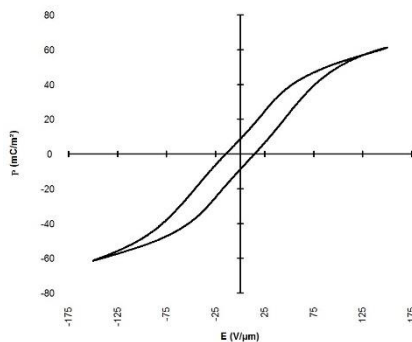


Figure 2. Hysteresis (P-E) curve for a Piezotech® RT-TS.

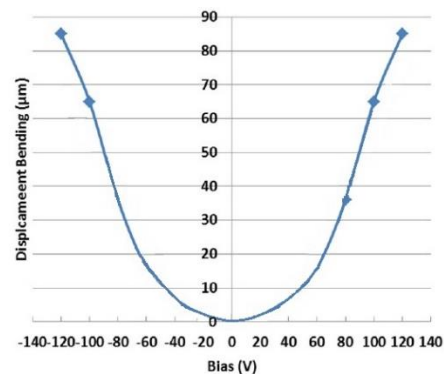


Figure 3. Displacement bending versus voltage for a 1 μm spincoated film of Piezotech® RT-TS

Applications: haptic devices, microfluidics, speakers, energy storage, high-k dielectrics for transistors, electrocaloric ...

I.3 Piezotech® RT-TS Typical Properties

Melting temperature (°C)	122	Electrostrictive coefficient ($\text{nm}^2 \cdot \text{V}^{-2}$)	M_{31}	5-10
Annealing Temperature (°C)	110	S_{33} (%)		2-5
Molecular weight, Mw ($\text{kg} \cdot \text{mol}^{-1}$)	400 - 600	Stress (MPa)		5-15
Relative Dielectric Permittivity, ϵ_r (1 kHz)	30-60	Elastic energy density ($\text{J} \cdot \text{cm}^{-3}$)		0.3 - 1
Tan Delta (1 kHz, 20 °C) (%)	2-5	Young Modulus (GPa)		0.1 - 0.5

II. Processing

II.1 Ink Formulation

Piezotech® RT-TS terpolymers are soluble in different solvents given in Annex 1. The concentration of the polymer in the solvent has to be adjusted in order to get the appropriate viscosity corresponding to the printing process used. The actual ink formulation can be obtained by progressively adding the polymer into the solvent under heating. In order to get homogeneous films with high electrical breakdown a filtering step of the solution is required (ideally 1 μm or less). This will remove impurities and prevent the formation of gel particles. Standard commercial filtering processes using filtering cartridges or filtering syringes are commonly used.

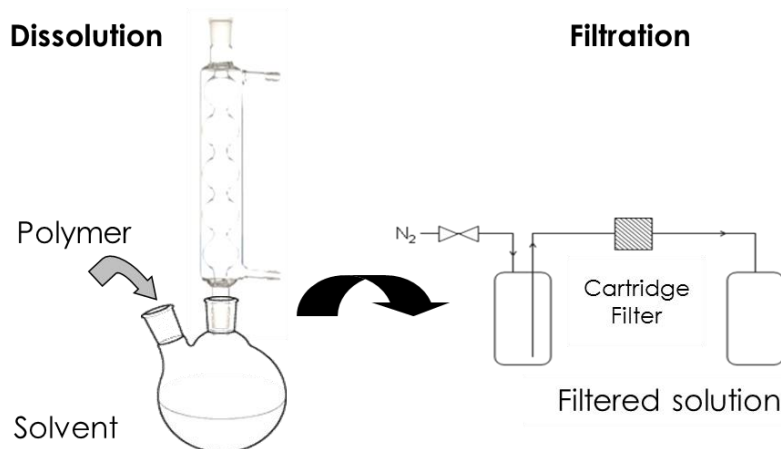


Figure 4. Ink formulation processing

II.2 Film Formation

Solution can be deposited via solvent cast, screen printing, spin-coating or other printing techniques on a glass, silicon, Polyimide, PEN... substrate under clean atmosphere until a homogeneous and dry film is formed.

Piezotech® offers a range of inks adapted to various printing process

II.3 Film annealing

Annealing is a critical step to provide film with the best properties, it will control crystallization of the material and enhance electrical as well as mechanical properties. Rapid annealing may be obtained on thin films using Infrared or flash annealing.

Annealing is typically performed 10-15 °C below the melting point. Annealing time can varies between 5 min and 2 hours depending on the targeted properties and applications.

II.4 Clean-up

The product and the different containers can be washed with ketones solvents (MEK (methyl ethyl ketone), Cyclopentanone ...).

II.5 Safety and Storage

Please refer to the safety datasheet

Annex 1. Possible Solvents for Piezotech[®] Polymers

Indicative list of solvents that can be used to dissolve & formulate Piezotech FC[®] and Piezotech[®] RT polymers.

	Boiling Point (°C)	Flash Point (°C)
Acetone	56	-18
Tetrahydrofuran	65	-17
Methyl Ethyl Ketone	80	-6
Methyl Isobutyl Ketone	118	23
Glycol Ethers	118	40
Glycol Ether Esters	120	30
N-Butyl Acetate	135	24
Dimethyl formamide	153	67
Cyclohexanone	157	54
Dimethyl acetamide	166	70
Diaceton Alcool	167	61
Diisobutyl Ketone	169	49
Tetramethyl urea	177	65
Ethyl Aceto Acetate	180	84
Dimethyl Sulfoxide	189	35
Trimethyl phosphate	195	107
N-Methyl-2-Pyrrolidone	202	95
Butyrolactone	204	98
Isophorone	215	96
Triethyl phosphate	215	116
Carbitol Acetate	217	110
Propylene Carbonate	242	132
Glyceryl triacetate	258	146
Dimethyl Phtalate	258	149

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