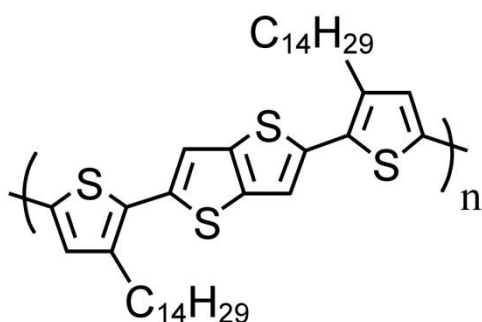


PBTTT

poly(2,5-bis(3-tetradecylthiophen-2-yl)thieno[3,2-b]thiophene) also known as PBTTT and also as PBTTT-C14. Now in stock for immediate dispatch. Product of Merck KGaA.



PBTTT has an increased mobility, stability, backbone rigidity and crystallinity compared to P3HT [1] and has demonstrated hole mobilities as high as 1 cm²/Vs [2]. Combined with good solubility in a range of common solvents this makes it possible to achieve high performance using a number of different coating techniques with mobilities as high as 0.1 cm²/Vs having been achieved with inkjet printing[3].

However, the advantages of PBTTT are not just better mobility and stability but also the opportunity for new and interesting science related to:

Liquid crystal behaviour [1]

Large crystal domains with easily identifiable boundaries[4]

Molecular terracing [5]

Anisotropic behaviour in the ribbon phase[6]

Luttinger liquid behaviour [7]

Physical Properties

Appearance: Dark red powder

Absorption (max, thin film): 550 nm

DSC (2nd Heat Cycle/Peak): T1 110 °C T2 220 °C

Solubility

Recommended Solvent: 1,2-Dichlorobenzene (10 mg/mL @ 80C)

Alternative Solvents: Tetralin, Decalin, Indan. These solvents will require heating to 80C

Comments: Gelation can occur on cooling the solution. This is a reversible process and the solution can be restored on heating.

Electrical Properties

Field effect mobility (Max): 1.0 x 10⁻¹ cm² /V.s

On/Off Ratio (Max): 10⁷

V_o : ~-20V (with SiO₂ dielectric)

Ionisation energy: -1.5eV

PBTTT

Storage and Stability

Solid polymer

Storage: Store in the dark under an inert atmosphere

Temperature: Can be heated to 180C without degradation

Processed Film Stability

Storage: Store in the dark under an inert atmosphere

Thermal stability: Stable up to 190C under an inert atmosphere

Atmospheric stability: For the best results measurements and processing should be carried out under an inert atmosphere.

Deposition from a warm solution gives highly uniform films.

Processing example (Field Effect Transistor)

Structure: Bottom Gate	Material	Process
Substrate	n-doped silicon/silicon dioxide (230 nm) as gate dielectric with Au electrodes (using ITO adhesion layer)	Substrate cleaning: <ul style="list-style-type: none"> • Sonicated in water • Sonicated in acetone • Sonicated in IPA • Ozone treated
Surface treatment layer	OTS	<ul style="list-style-type: none"> • Treatment is necessary to enhance transistor properties • OTS – 10mM in toluene with ~150 ppm water • Immerse substrate in the OTS solution for 20 min at 60 °C
OSC	PBTTT	<ul style="list-style-type: none"> • 10 mg/mL solution in 1,2-dichlorobenzene used • Spin at 3000 rpm, with 1 s acceleration, for 3 min • Anneal at 100 °C for 10 min • Processing under inert atmosphere is advised
Typical Values	$\mu = 1.0 \times 10^{-1} \text{ cm}^2/\text{V.s}; \text{ On/Off} = 10^7$	

PBTTT

Structure: Top Gate	Material	Process
Substrate	PEN	Substrate cleaning: •Sonicated in methanol 1 min then dried
Source/Drain	Au	•Deposit to ~30 nm thickness
Contacts SAM	M001	• Cover substrate for 1 min before spinning •Spin at 500 rpm for 18 sec • Rinse with IPA
OSC	PBTTT	•5 mg/mL solution in 1, 2-dichlorobenzene •Spin at 3000rpm for 2 min •Anneal at 100C for 1 min with cover •Processing in yellow light is advised
Dielectric	D139-FC43-045	•Spin at 500 rpm for 10s with 2s acceleration •Final spin speed at 1000rpm for 20 s with 3s acceleration •Baked in oven at 100C for 20 min •Approx thickness of 500 nm
Gate	Au	•Deposit to ~30nm thickness
Typical Values	$\mu = 4.0 \times 10^{-2} \text{ cm}^2/\text{V.s}$; On/Off = 10^4	

References (please note that Ossila is in no way affiliated with any other research group mentioned within these references):

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- [7] *Nonlinear transport in semiconducting polymers at high carrier densities*. J. D. Yuen, Nature Materials, V8, P572 (2009).