

Product Information

Poly(3-hexylthiophene-2,5-diyl)

Catalog Number **698989**
Store at Room Temperature
Technical Bulletin AL-248

TECHNICAL BULLETIN

CAS RN 156074-98-5
Synonyms: P3HT; Plexcore® OS 1100

Product Description

Plexcore OS 1100, a p-type polymer semiconductor, is a moderate molecular weight grade of P3HT that is optimized for Organic Field Effect Transistor (OFET) applications. It has been used successfully in top and bottom-gate OFET architectures with a variety of device dimensions, substrates, and dielectrics. For bottom-gate OFET, SiO₂ is typically encountered in the open literature when a silicon wafer is used as the gate electrode. A number of other dielectrics are available for use with other substrates. Top-gate OFET devices require rather unique organic dielectrics that do not affect the organic semiconductor during its processing.

Plexcore OS 1100 has metal impurities less than 50 ppm. The specific impact of metallic impurities is dependent on which metals are present and at what concentration. There isn't a significant impact on OFET performance due to metal impurities at this stated level, although this does not rule this possibility out due to end-use application.

Purity: 99.995% (trace metals basis)

head-to-tail regioregular: >95% (¹H-NMR)

Fluorescence properties: λ_{ex} 450 nm; λ_{em} 575 nm

Typically, higher molecular weight results in higher hole carrier mobilities for OFETs. The cause of this effect is not well understood.

Average M_n: 25,000–35,000
M_w/M_n <2

Mobility is extracted from the OFET transfer curve in the saturation region (i.e., from the slope of $\sqrt{I_{\text{ds}}}$ vs. V_g curve) and is impacted by device architecture. In general, mobilities are higher for smaller OFET channel lengths. However, different device architectures will have behavior unique to that particular design.

Precautions and Disclaimer

This product is for R&D use only, not for drug, household, or other uses. Please consult the Material Safety Data Sheet for information regarding hazards and safe handling practices.

Preparation Instructions

Typically, aromatic and halogenated aromatic solvents are used. The product is soluble in trichlorobenzene, chlorobenzene, toluene, and xylenes. In addition, chloroform and, to a lesser degree, tetrahydrofuran (THF), are both options.

Storage/Stability

Store the product at room temperature.

In general, conjugated organic semiconductors (like Plexcore OS) may be sensitive to some (higher energy) wavelengths of light in the presence of oxygen. While this is not an acute problem for the bulk material, solutions and thin films tend to show some sensitivity over time. Therefore, storage and handling in an inert atmosphere (like nitrogen or argon) is recommended. A yellow filter light is a standard feature for processing these materials outside of a glove box. A combination of inert atmosphere and yellow light filter is best.

Procedure

Note: A yellow filter light is a standard feature for processing these materials outside of a glove box. Storage and handling in an inert atmosphere (like nitrogen or argon) is recommended.

Typical Bottom-Gate OFET Architecture (see Figure 1):

- Substrate: Silicon/SiO₂ wafer
- Gate: Silicon
- Dielectric: SiO₂ treated with HDMS
- Organic Semiconductor: Plexcore OS 1100
- Source/Drain: Au/Ti

Poly(3-hexylthiophene-2,5-diyl) (Plexcore OS 1100) solution:

Prepare a 5–20 mg/ml solution in an appropriate solvent or solvent blend (chloroform, toluene, xylene, chlorobenzene, o-dichlorobenzene, trichlorobenzene). Shake the solution at 40 °C (until well dissolved). Filter the solution with a 0.2 μm PTFE syringe filter.

Substrate Preparation:

Prior to spin coating, typical substrate preparation includes sonication with solutions such as distilled water, detergent water, isopropyl alcohol (electronic grade). After sonication, the substrate should be dried with a nitrogen gun.

Film Deposition via Spin Coating:

Using a filter syringe, apply the organic semiconductor onto the substrate surface. Using a spin coater, spread the solution at 350 rpm for 5 seconds and spin at 600–2,000 rpm for ~2 minutes. This will require optimization based on spin coating equipment and device architecture.

Drying Conditions:

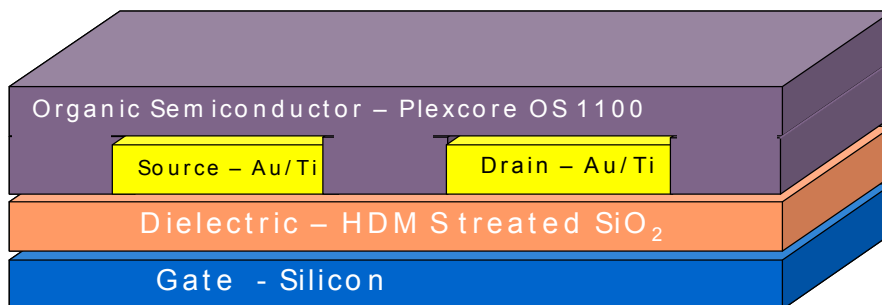
Anneal at 100–175 °C for 5–60 minutes.

Plexcore is a registered trademark of Plextronics, Inc. Product of Plextronics, Inc. U.S. Patent 6,166,172.

DC,IK,MAM 02/14-1

Figure 1.

Schematic of OFET using Plexcore OS 1100



HDMS: hexamethylenedisilazane
Au/Ti: gold/titanium