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OFET

Organic Field Effect Transistor

of Hamed Fooladvand

Supervised by Dr. Kiyani

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A paper describing

Use of side chain thiophene containing copolymer as a non-ionic gel-dielectric material for sandwich OFETassembly

Busra Sengez [a], Zekeriya Dog˘ruyol [b], Sait E. San [c], Arif Kosemen [c], Faruk Yılmaz [a], Mustafa Okutan [b], Yusuf Yerli [c], Ahmet Demir [c], Engin Basaran [d]

a Department of Chemistry, Gebze Institute of Technology, Kocaeli 41400, Turkey
b Department of Physics, Yıldız Technical University, _Istanbul 34220, Turkey
c Department of Physics, Gebze Institute of Technology, Kocaeli 41400, Turkey
d Department of Engineering Physics, _Istanbul Medeniyet University, _Istanbul 34720, Turkey

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INTRODUCTION

- Organic Field-effect Transistor (OFET) is a three terminal device whose characteristics can be modulated by the electrical field.

- It is composed of organic conjugated molecules as active channels, inorganic or polymer insulators as dielectric layer and metals as electrodes.

INTRODUCTION

- Among the many soluble polymers, regio-regular poly(3-hexylthiophene) (rr-P3HT) has been extensively studied in organic field-effect transistors (OFETs) due to its comparatively high **hole** carrier mobility, simple solution process ability, and commercial availability.

- Also, The use of organic dielectric polymers such as **PMMA** has generally resulted with relatively high mobility and better device reliabilities compared to that of the highly process dependent $\mathbf{SiO_2}$.

INTRODUCTION

Aim of this Paper

- The aim of this work briefly is to realize sandwich-processed OFETs operating at low supply voltages and so, enhance the field effect mobility with use of appropriate gel copolymer gate dielectric for future organic circuit applications.

- For this purpose, P3HT based OFET assembly with gel-PMMA/PC dielectric was compared with that containing gel-P(MMA-co-MTM)/PC dielectric.

INTRODUCTION

Aim of this Paper

- At the same time it was demonstrated for the first time that the fabrication of thiophene-based dielectric material by integration of PC, without any polyelectrolyte containing anion groups, as a gate non-ionic-gel-gated OFET (a so-called non-ionic gel-OFET).

- The inspiration of This approach mainly targets on the exploitation of interfacial effects by a novel dielectric copolymer for better compatibility, which is supposed to provide better output characteristics in the device.

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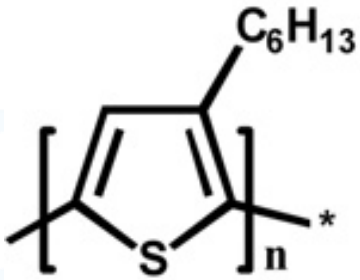
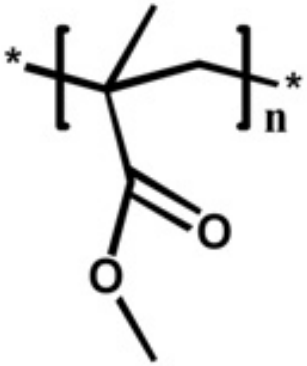
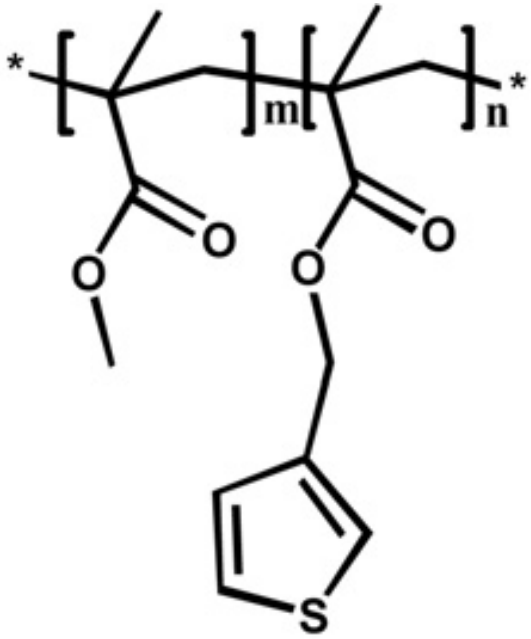
MATRIALS



P3HT

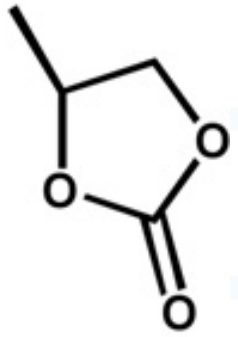


PMMA



methylthienyl methacrylate

P(MMA-co-MTM)



PC

Propylene carbonate

- The chemical structures of the polymers and propylene carbonate used in this study

SYNTHESIS

- Composition data for free-radical copolymerization of MMA with MTM

	Molar ratio (MMA\MTM)	Components ratio[a] (MMA\MTM) (%)	Efficiency[b] (%)	M_n[c] (g/mol)	PDI[c]
P(MMA-*co*-MTM)	3\1	74\26	49.7	68261	2.24

[AIBN]/Monomers = 1×10^{-2}, time = 3 h, temperature = 65 °C.

[a] Obtained from $_1$H-NMR spectroscopy.

[b] Overall monomer conversion.

[c] Determined by GPC based on PMMA standards.

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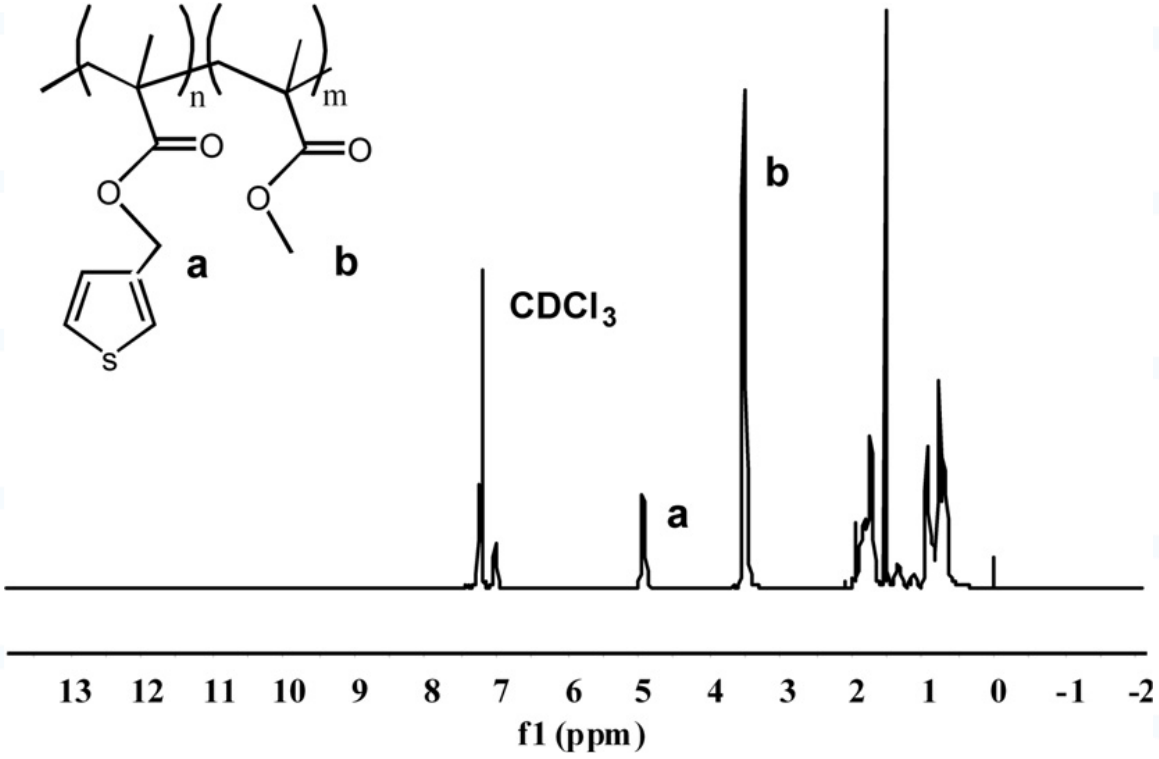
SYNTHESIS

- H-NMR spectrum of Poly(MMA-co-MTM).



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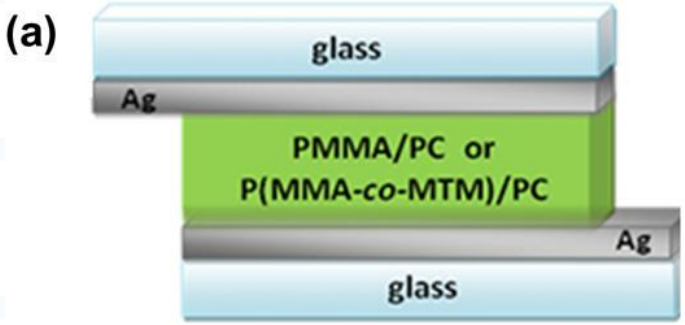
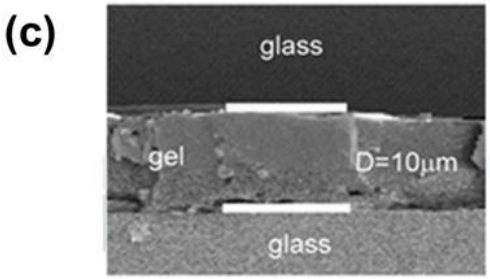
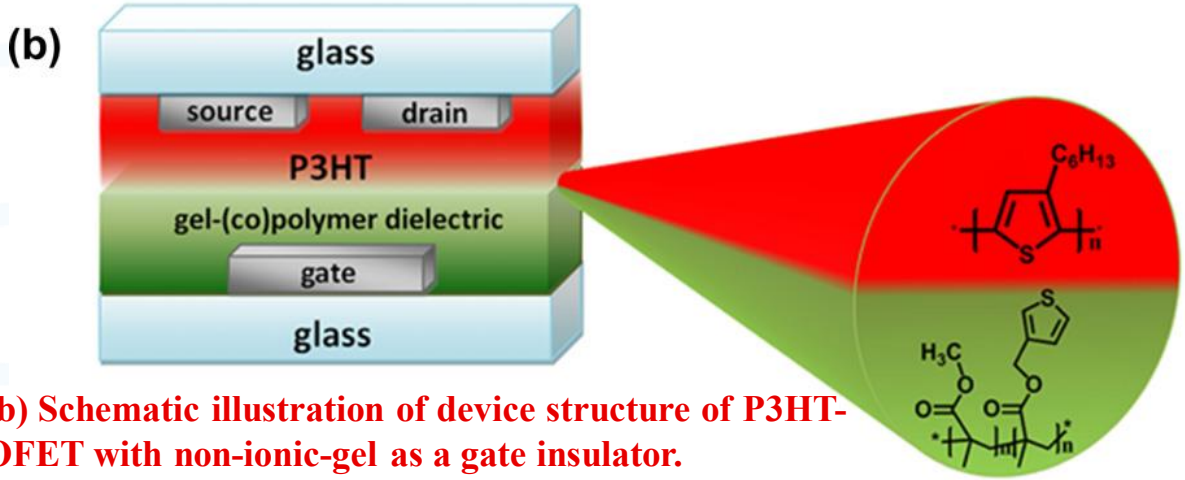
OFET FABRICATION



(a) Schematic illustration of a capacitor with silver electrode



(c) SEM image of gel thickness



(b) Schematic illustration of device structure of P3HT-OFET with non-ionic-gel as a gate insulator.

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OFET FABRICATION (at Labratoary)

www.youtube.com/watch?v=PE8Att1iiFA

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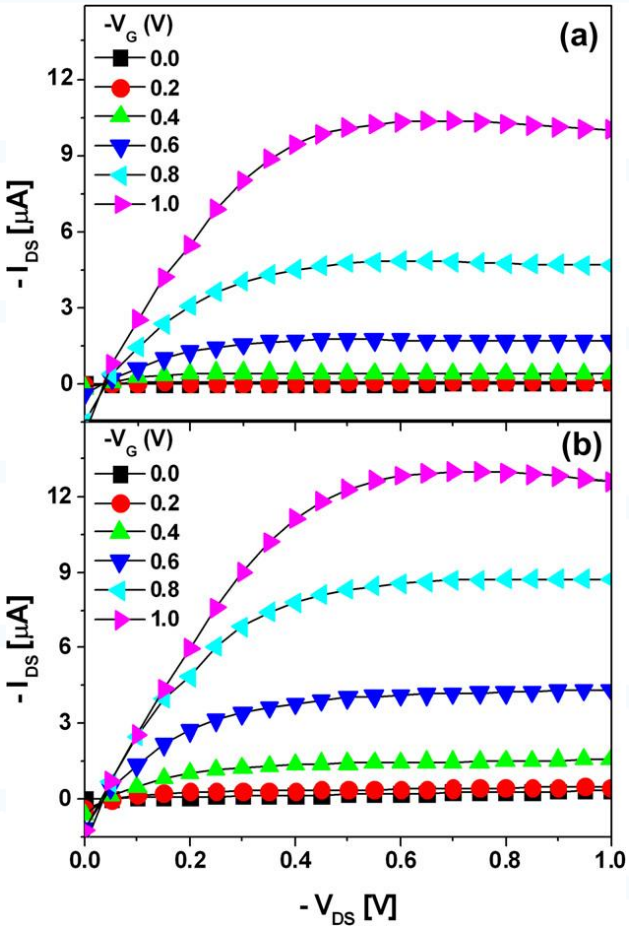
RESULTS & DISCUSSION

Output characteristics

- **Output characteristics of both P3HT-OFETs**

a) gel-PMMA/PC

b) gel-P(MMA-co-MTM)/PC



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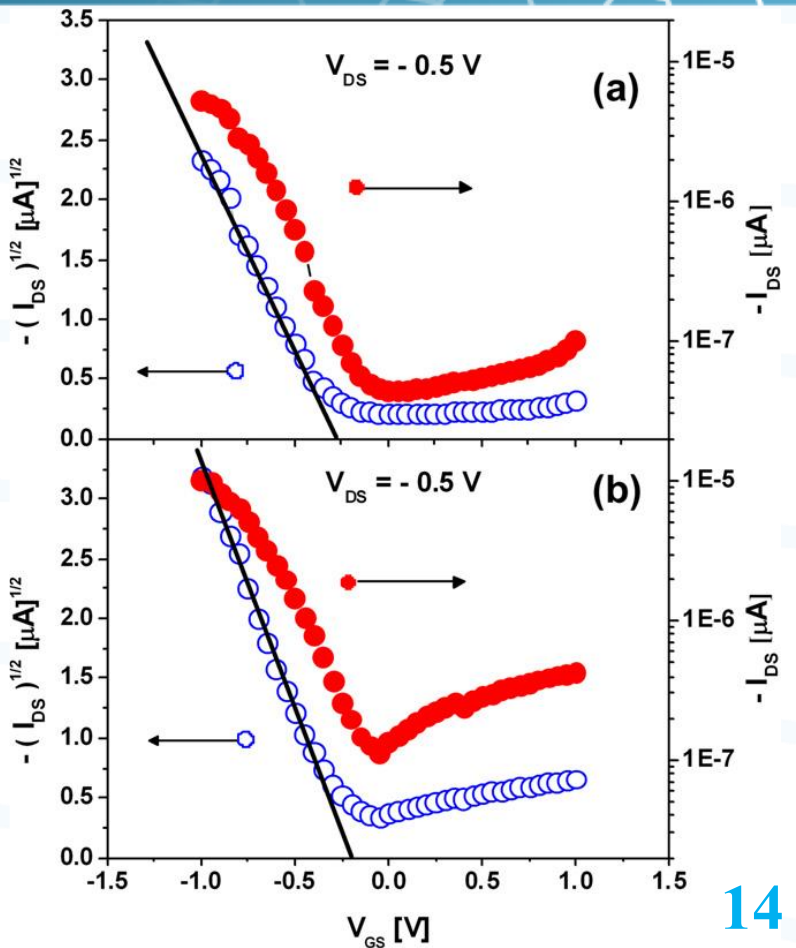
RESULTS & DISCUSSION

Transfer characteristics

- **Transfer characteristics of both P3HT-OFETs**
  - a) gel-PMMA/PC
  - b) gel-P(MMA-co-MTM)/PC



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Future Applications of OFET

Application of OFET in Smart Phone

Application of OFET in Display

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My God is My HERO … !

WITHOUT HIM THIS WORLD WOULD BE EMPTY …

Thanks a Lot
For Your Attention