

Electrical Characterization of pn-junctions of PPV and silicon



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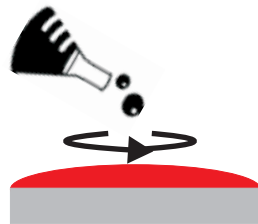
Introduction

✦ Comparison of

MEH-PPV

PPV grown via precursor route

1. spin coat soluble PPV



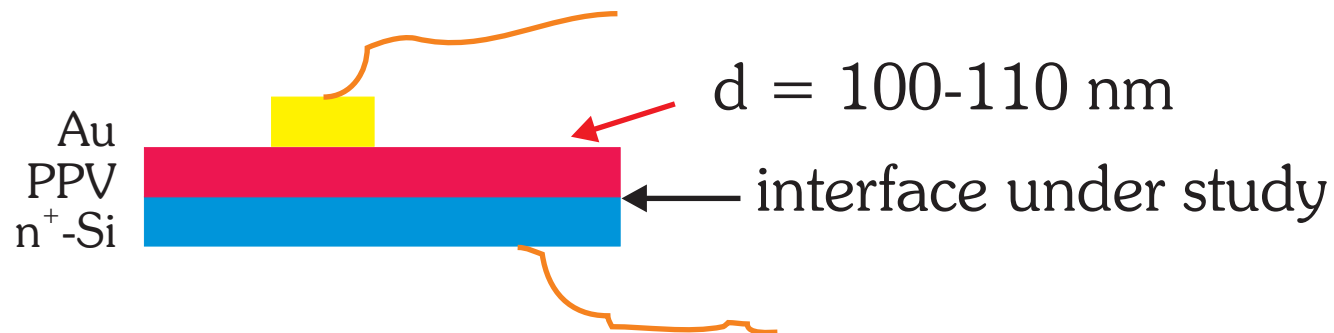
1. spin coat precursor



2. polymerize 12h, 180 °C, vac.



✦ Studied by interface structures: asymmetric pn junctions

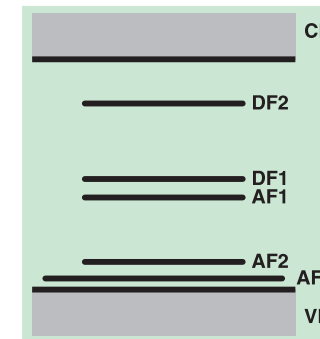
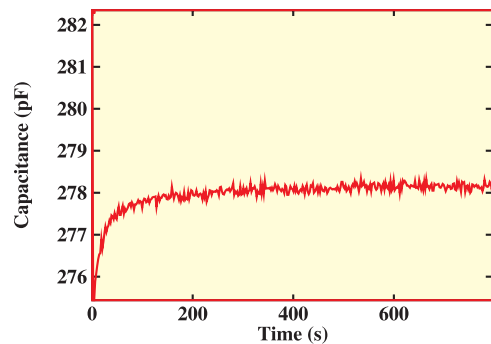


previous study: MEH-PPV

1: Successful DLTS experiment - identification of discrete traps

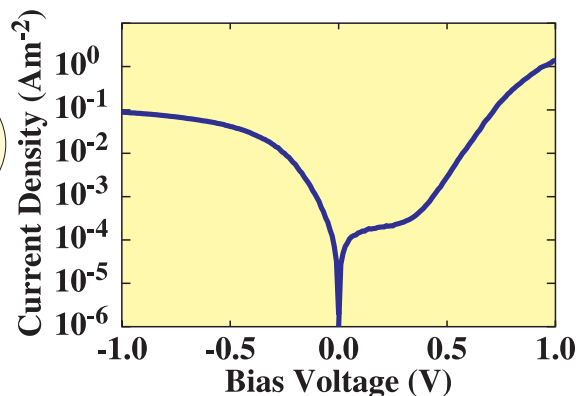
H.L.Gomes, et al.
Appl. Phys. Lett. 74, 1144 (1999)

Ct:

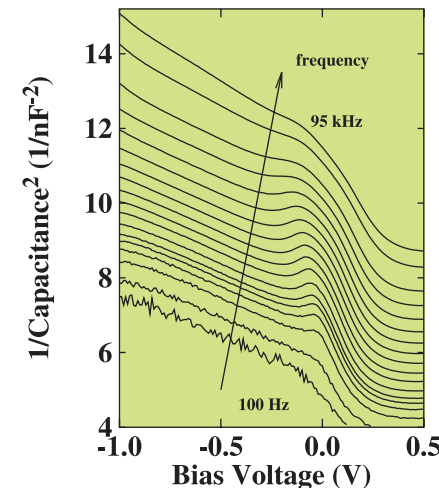


2: Identification of minority-carrier effects

IV:



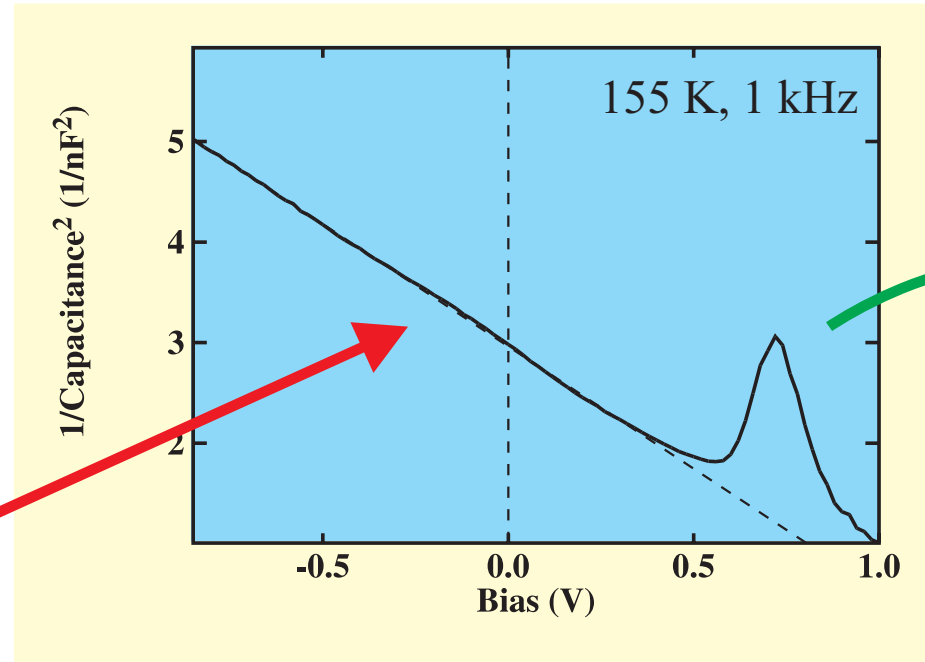
CV:



P. Stallinga et al.
to be published
J. Appl. Phys.

(precursor) PPV: CV

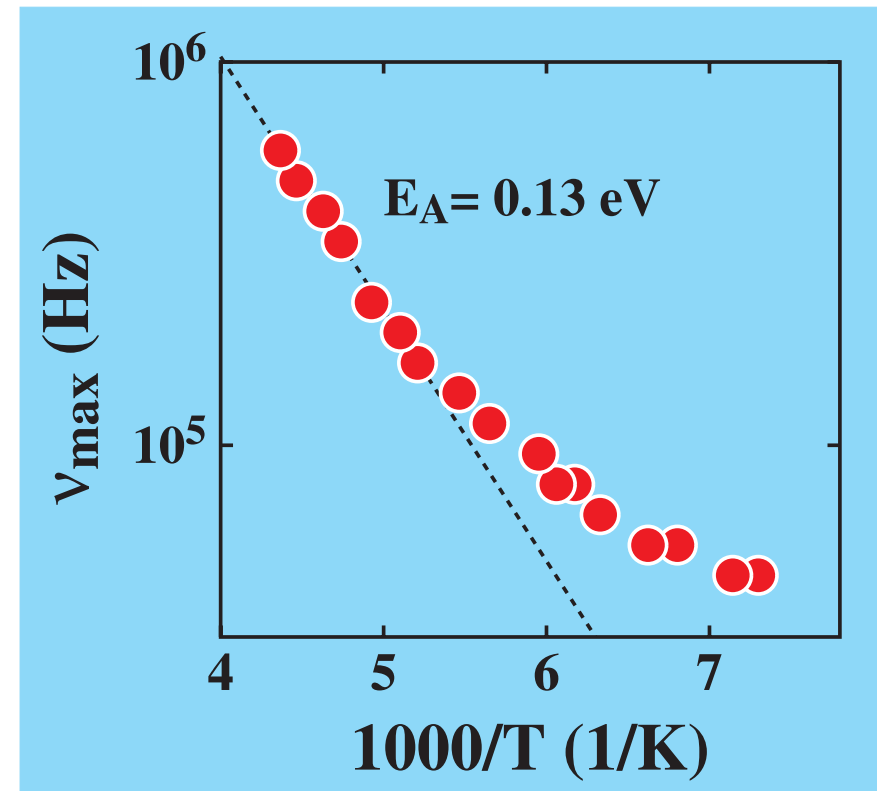
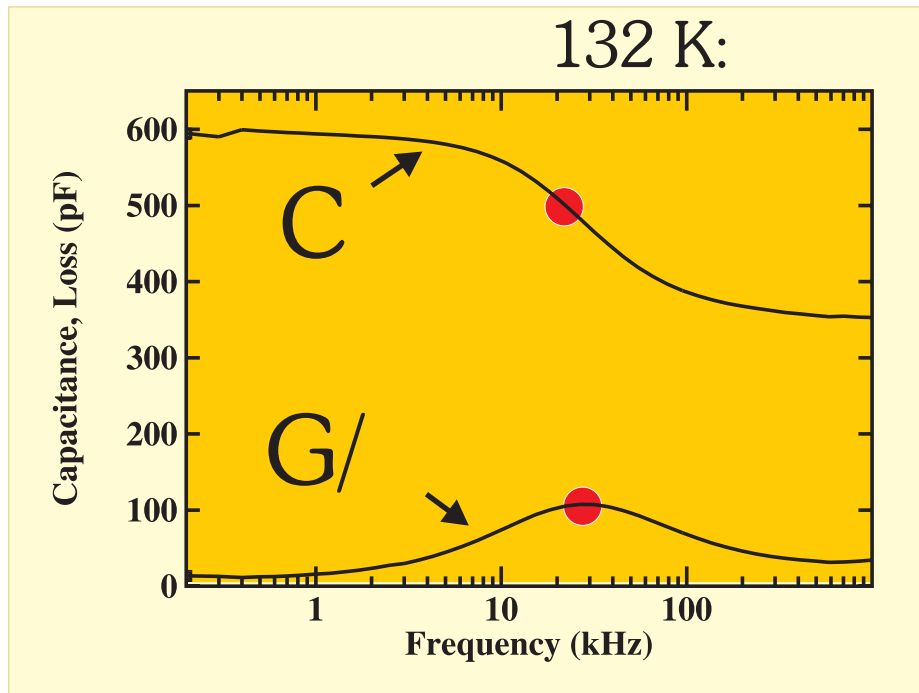
slope of $1/C^2$ vs. V
 $N_A = 1 \cdot 10^{16} \text{ cm}^{-3}$



Inductance

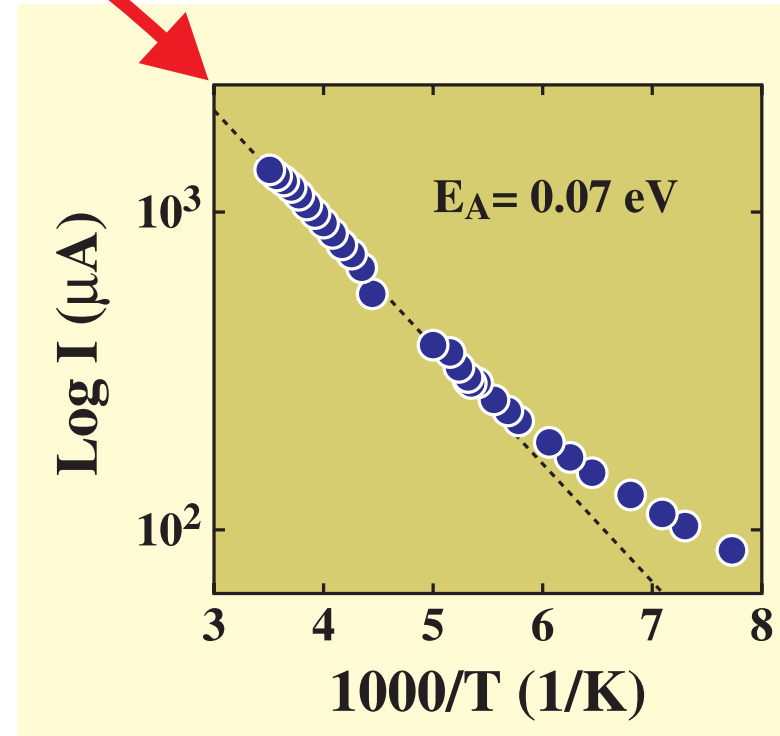
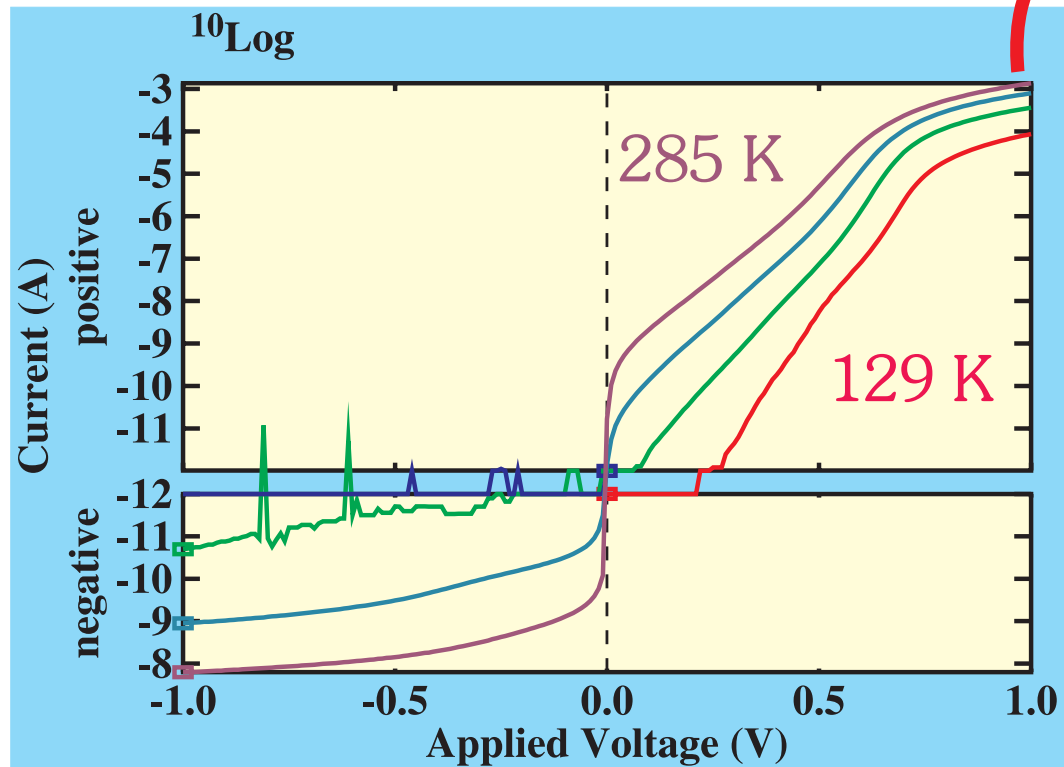
- free carrier density of precursor-PPV and MEH-PPV similar
- Inductance effects of minority carriers.

PPV: C, G- plots



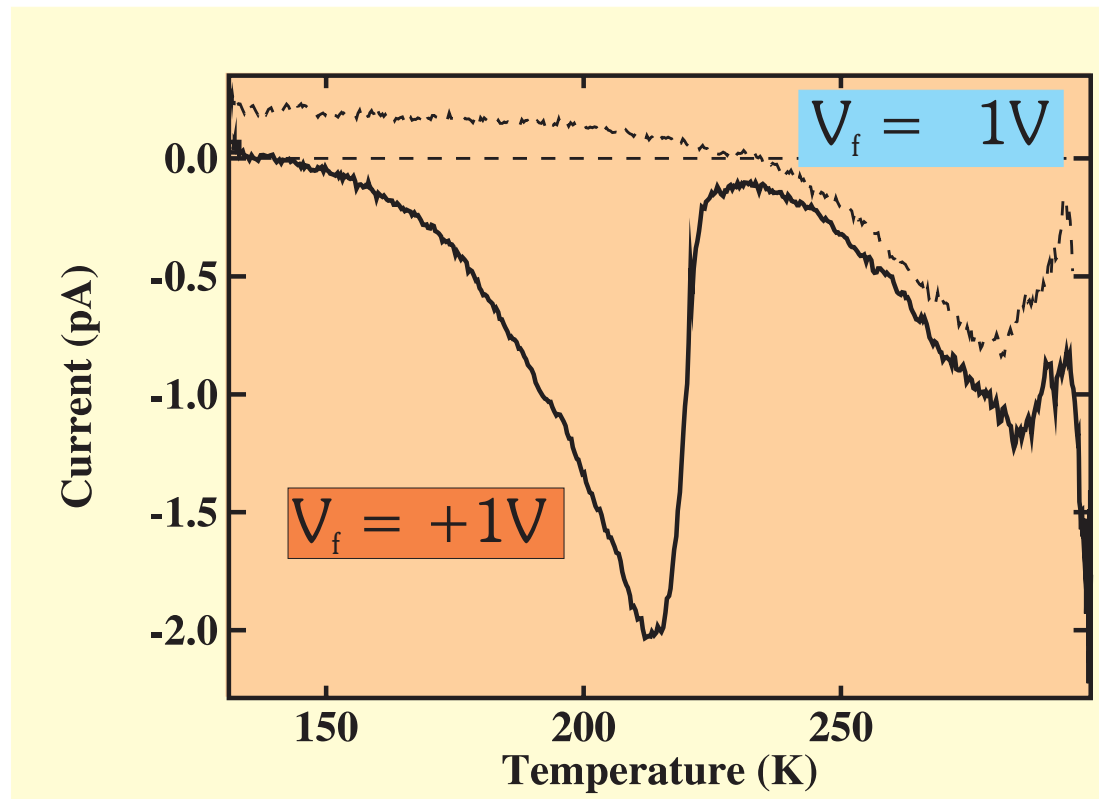
- relaxation peak in loss-tangent (G/ C)
- $E_A = 0.13 \text{ eV}$ (MEH-PPV: 0.12 eV)

PPV: IV plots



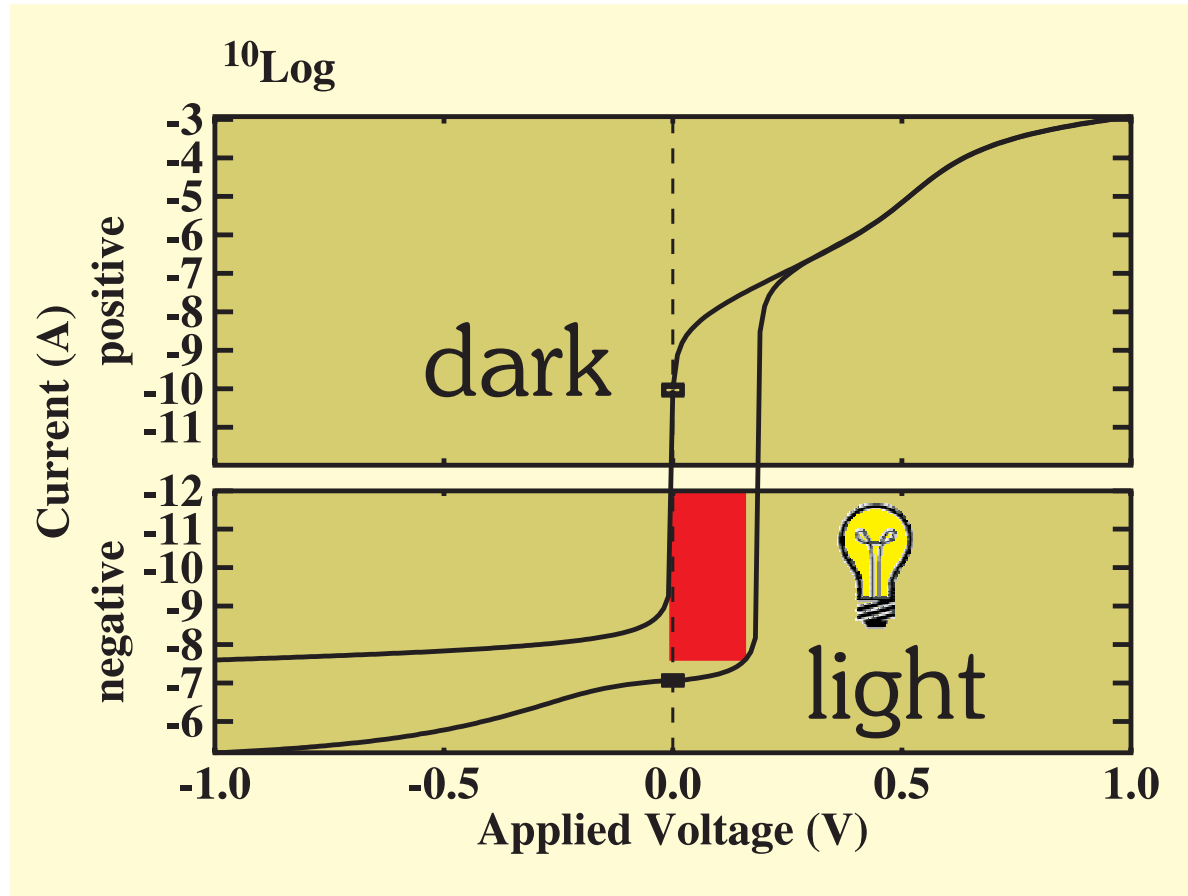
- plateau in forward bias region
- at +1V: $E_A = 0.07 \text{ eV}$

PPV: TSC



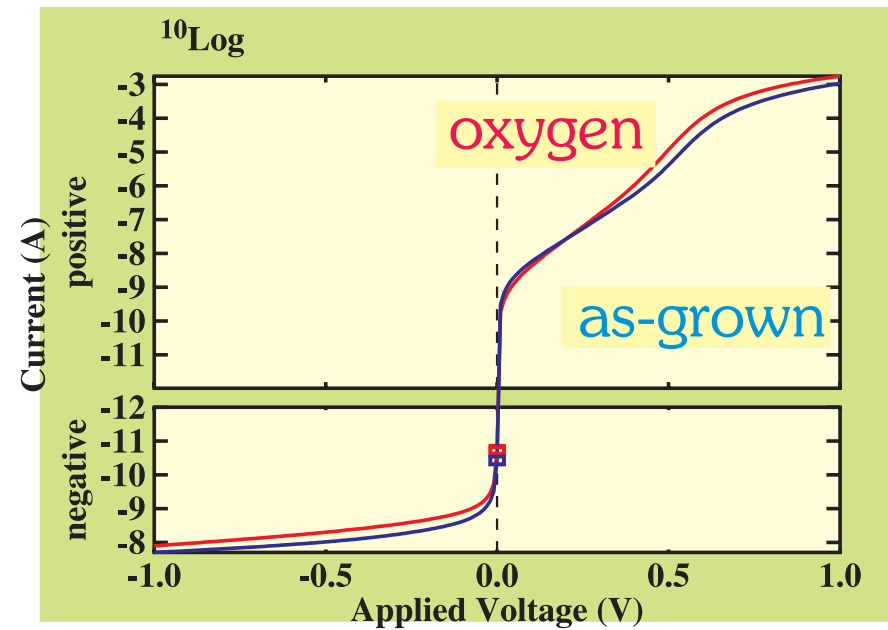
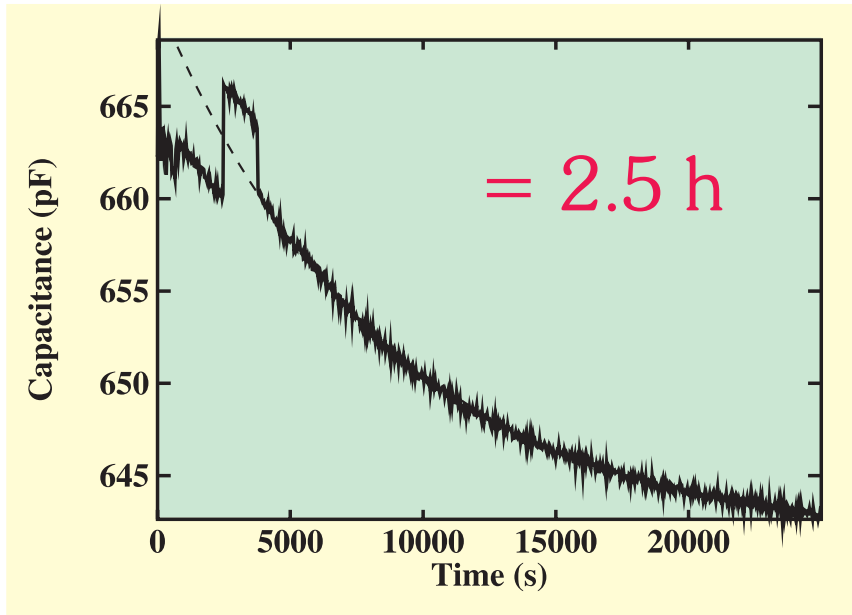
- peak in TSC indicating deep states

PPV: Optical



- Remarkably high fill factor: $FF=0.67$

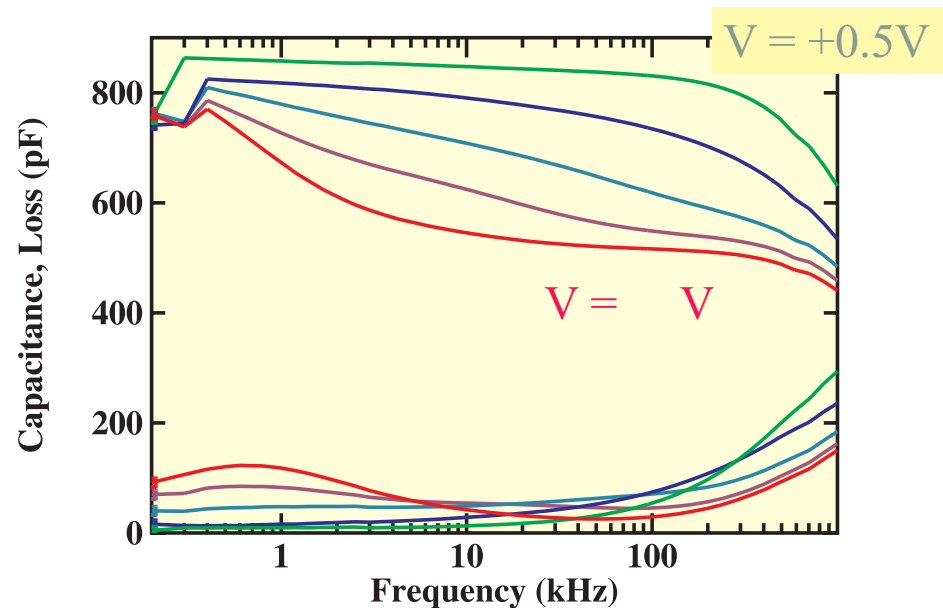
PPV: Effect of oxygen



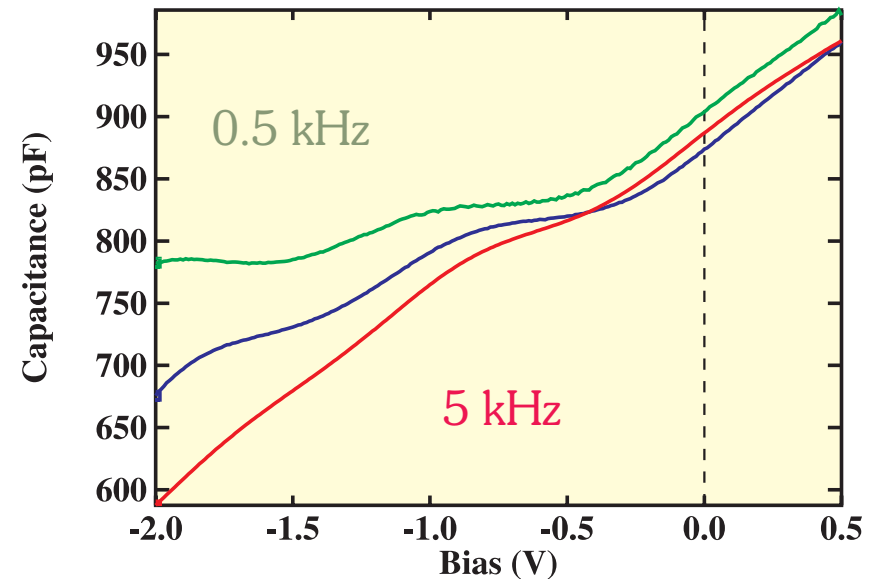
- Effect of oxygen on the capacitance and IV plots. Doping or undoping?!

PPV: Deep states

spectra



CV plots



- At reverse bias deep states show up on the spectra and CV plots

PPV: Summary

- PPV grown via precursor route behaves like MEH-PPV
 - IV, CV: minority-carrier effect
 - TSC: deep states
 - CV: free-carrier density
- Effects of oxygen. Doping or undoping?!