157nm Resist Materials: 2-Trifluoromethylacrylates

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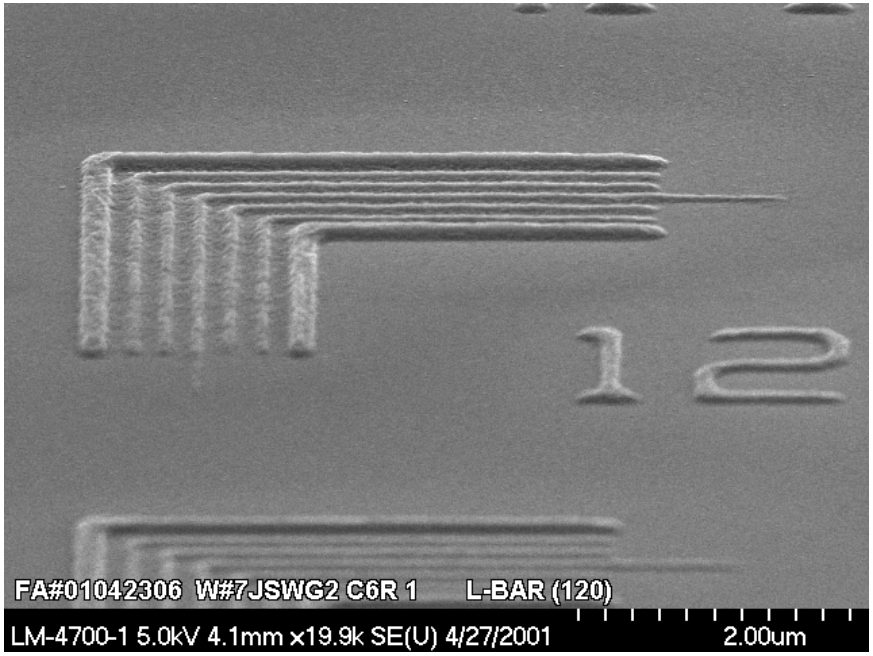
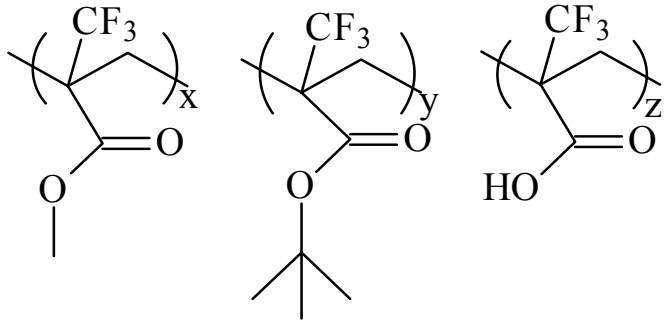
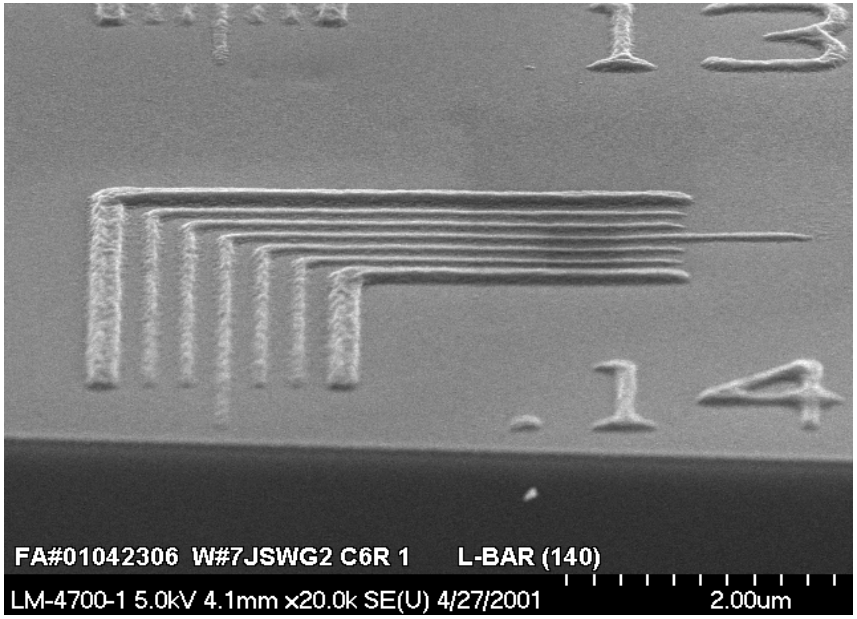
Previous Work

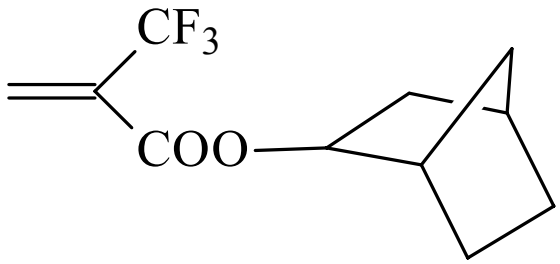


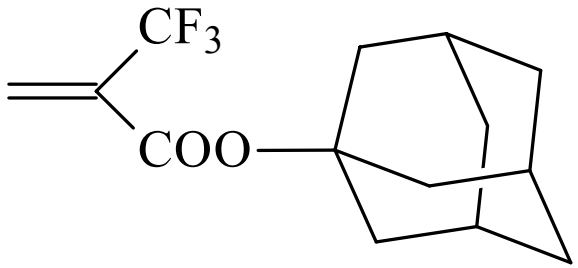


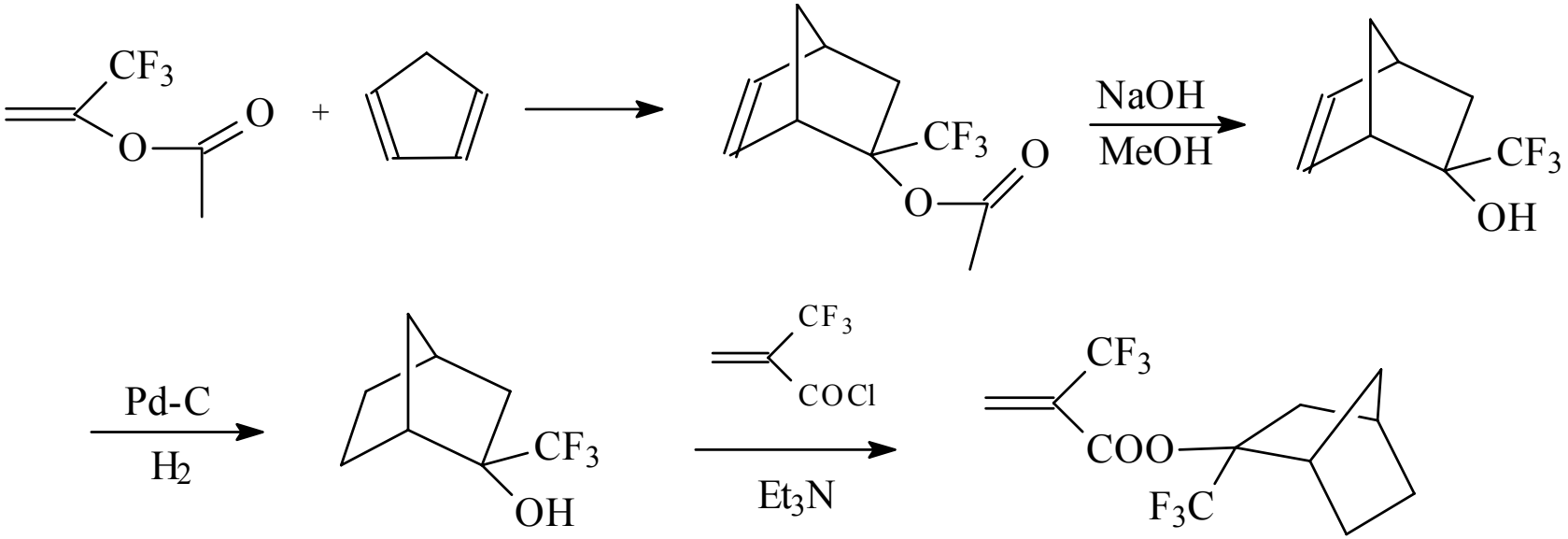


- Poor contrast
- Absorbance at 157 nm = 3/um
- Low T_g
- Protection/Deprotection Step

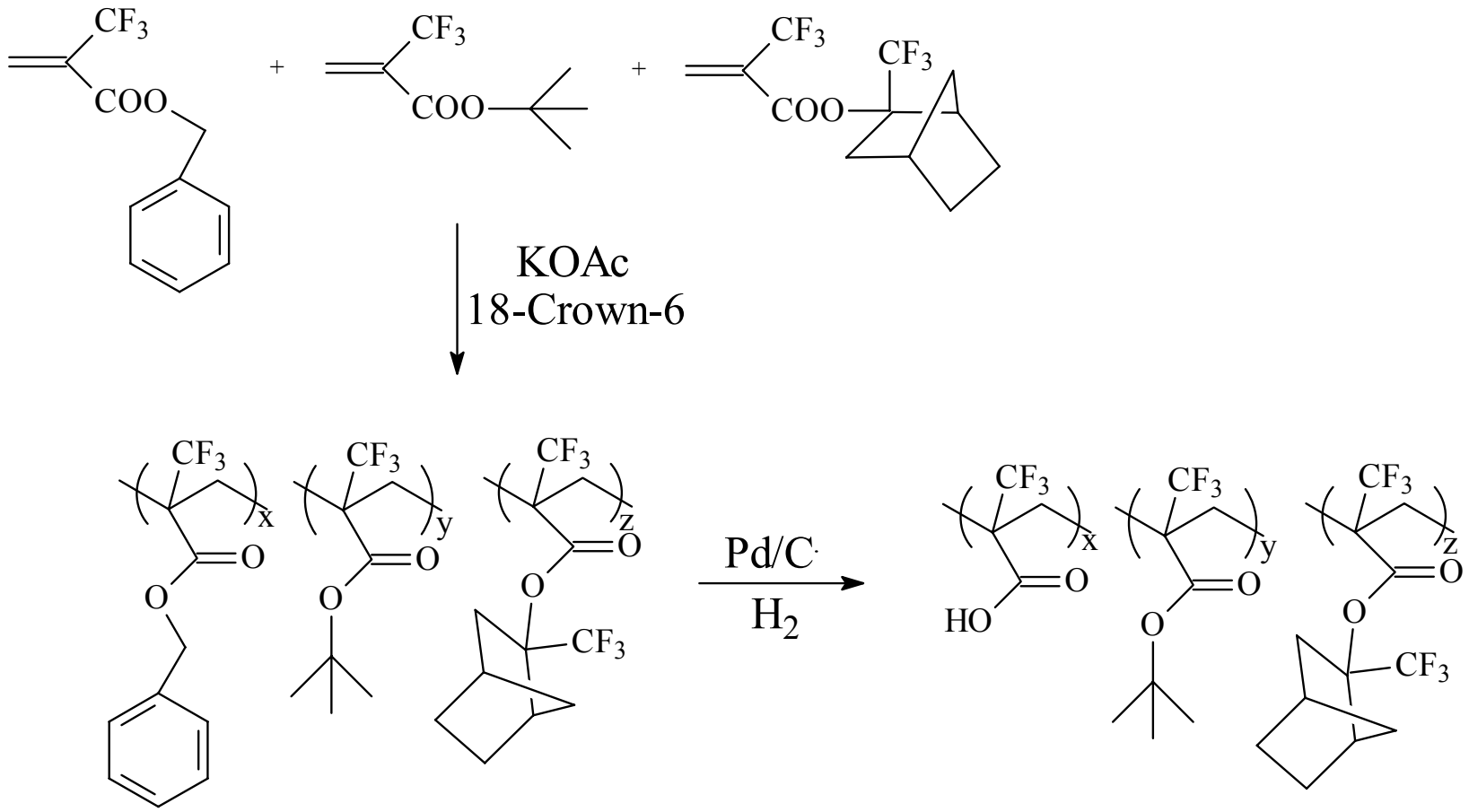
Etch Resistant Moieties



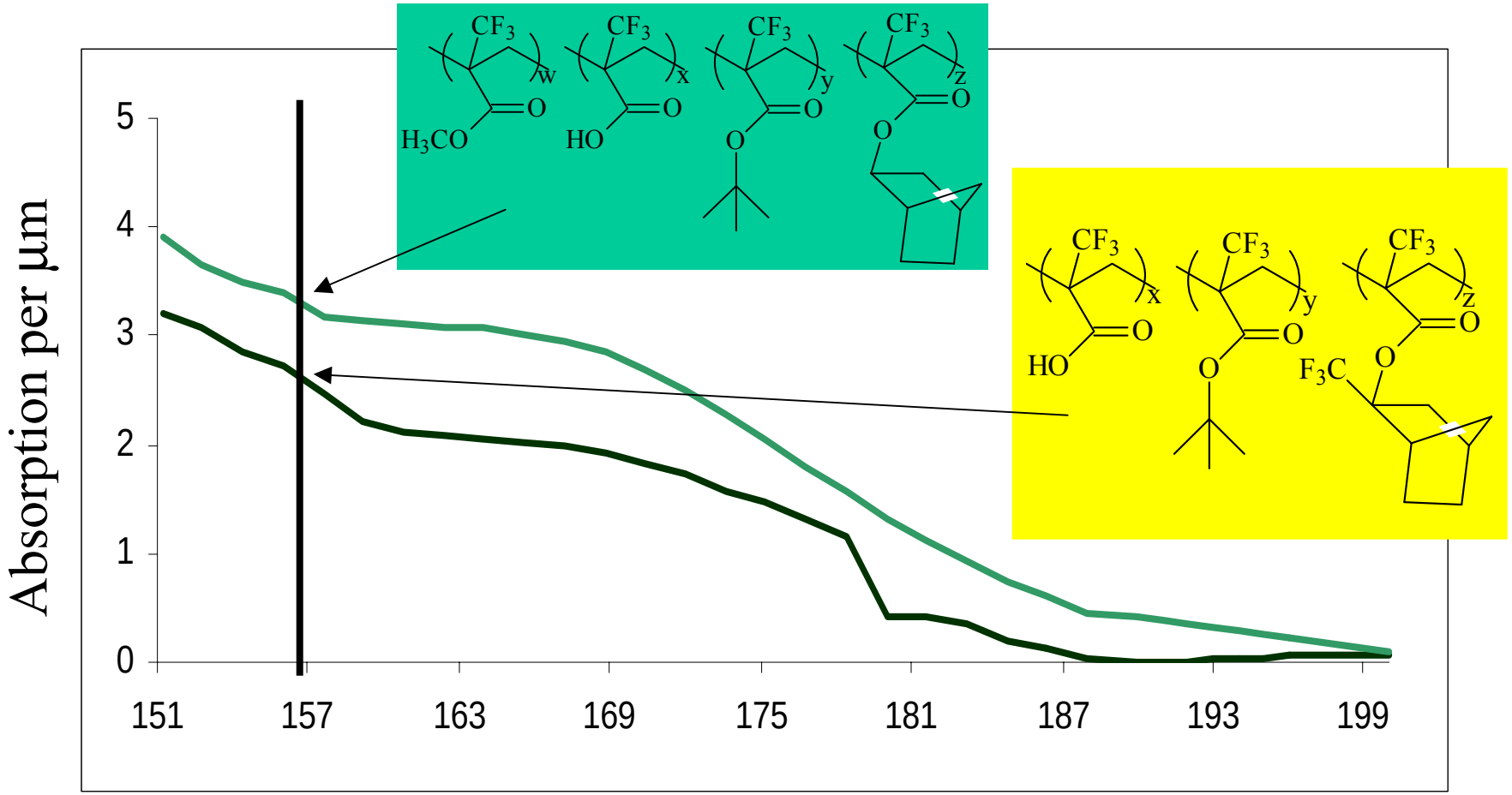




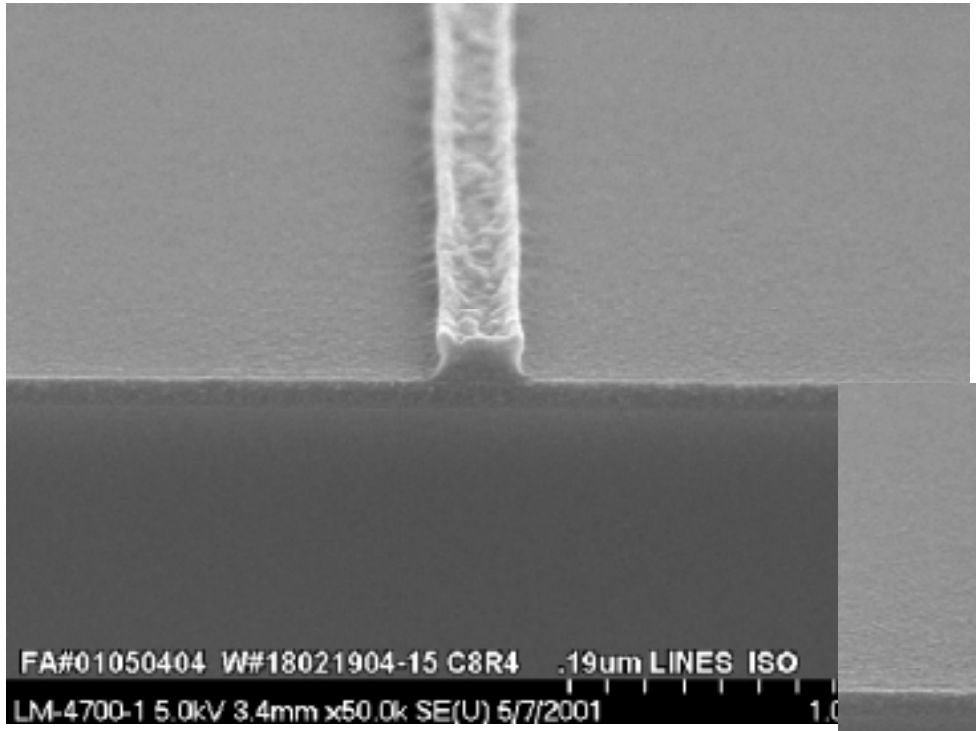
Polymer Synthesis

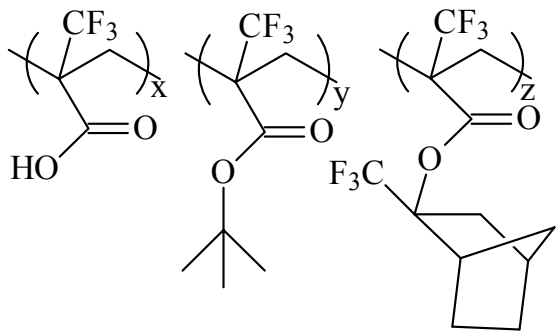


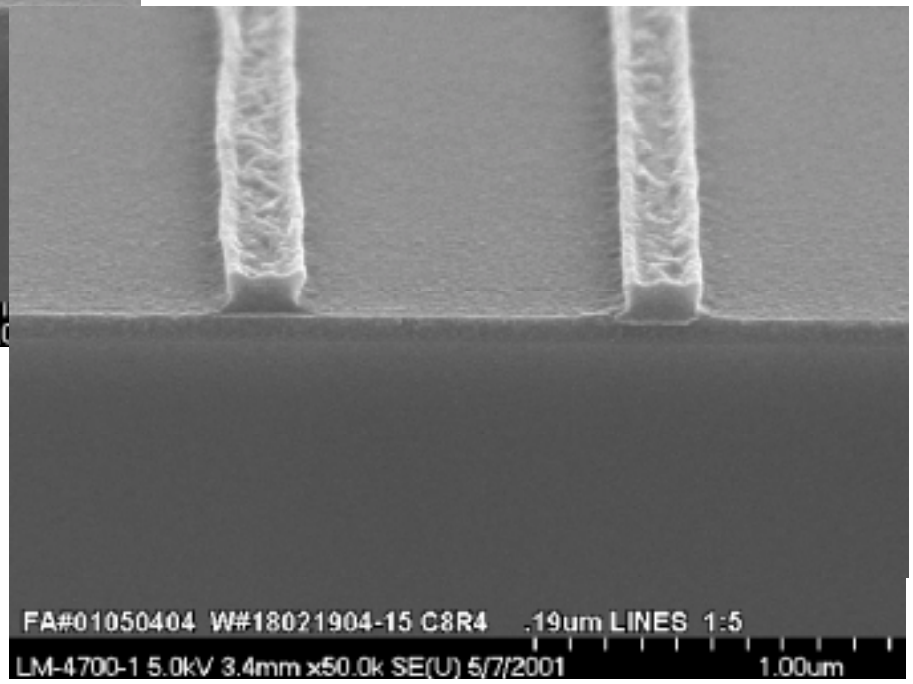
VASE Spectroscopy



Preliminary 157 nm Imaging Studies

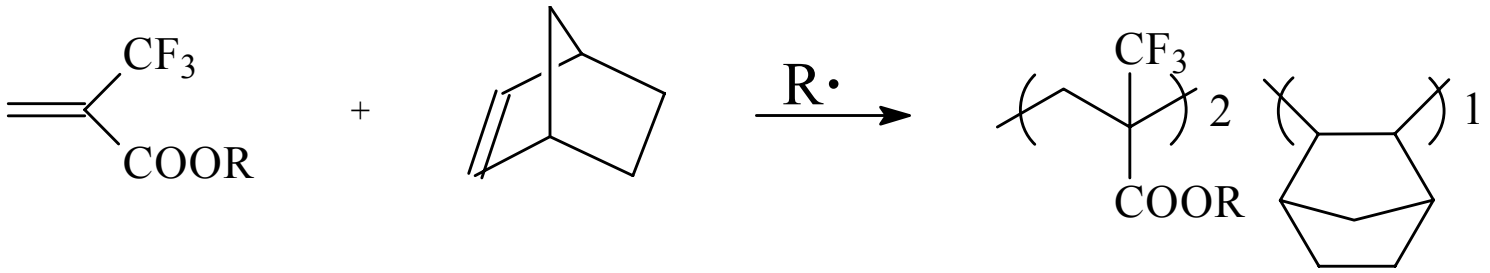




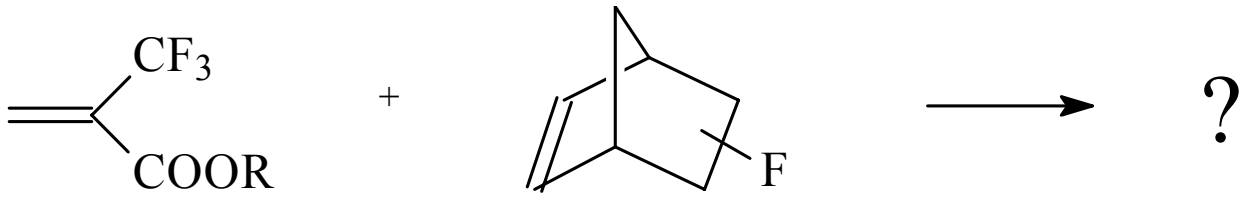


- Improved contrast
- Lower absorbance at 157 nm
- T_g is still low
- Protection/deprotection step

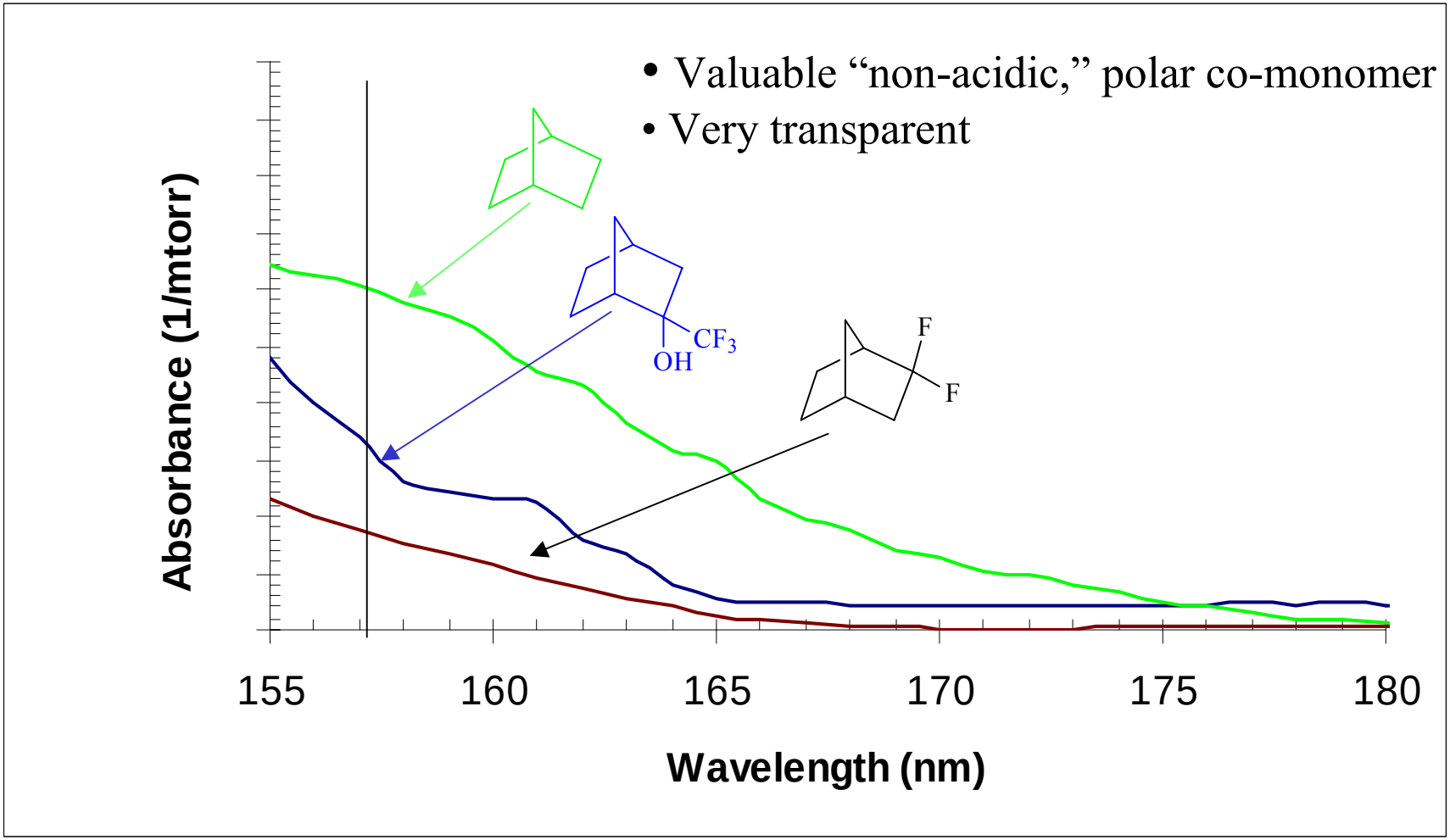
Incorporation of F-Norbornene in Polymer Backbone



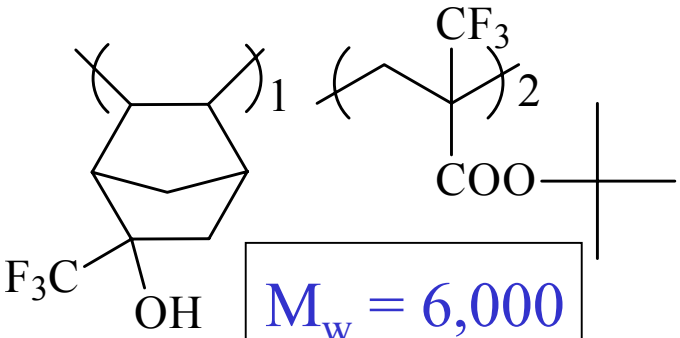
*H. Ito, G. Wallraff, P. Brock, N. Fender, H. Troang, G. Breyta, D. Miller, M. Sherwood, R. Allen, Proc. SPIE 2001.



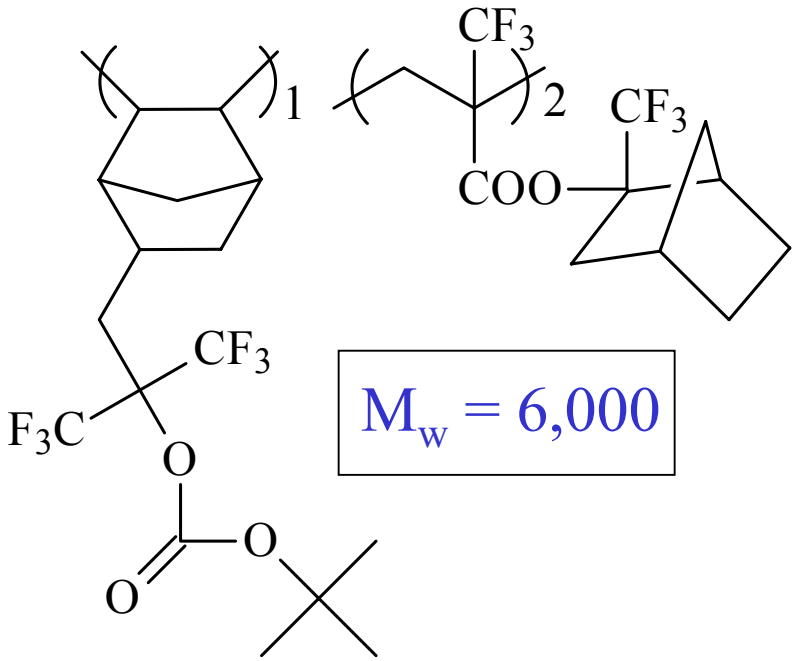
2-Trifluoromethylbicyclo[2.2.1]heptan-2-ol



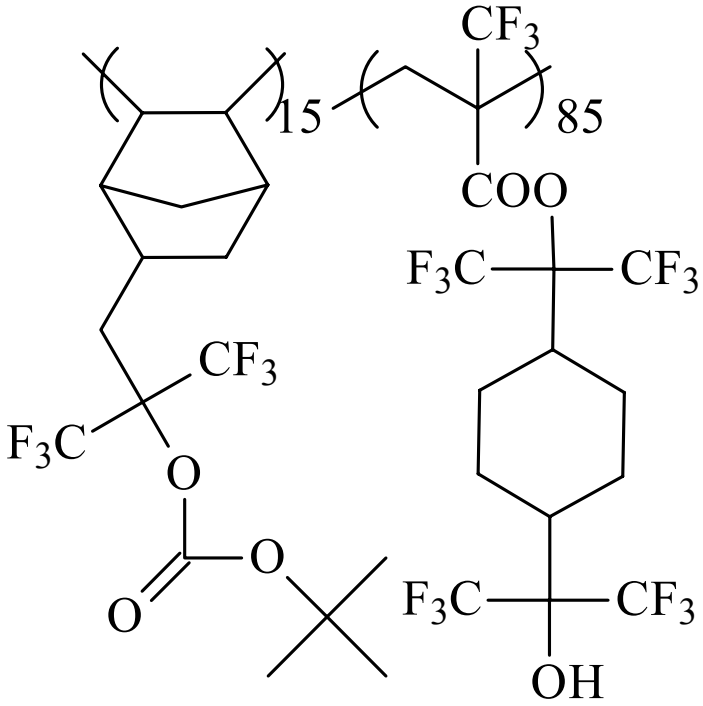
Co-Polymerization Results



$M_w = 6{,}000$

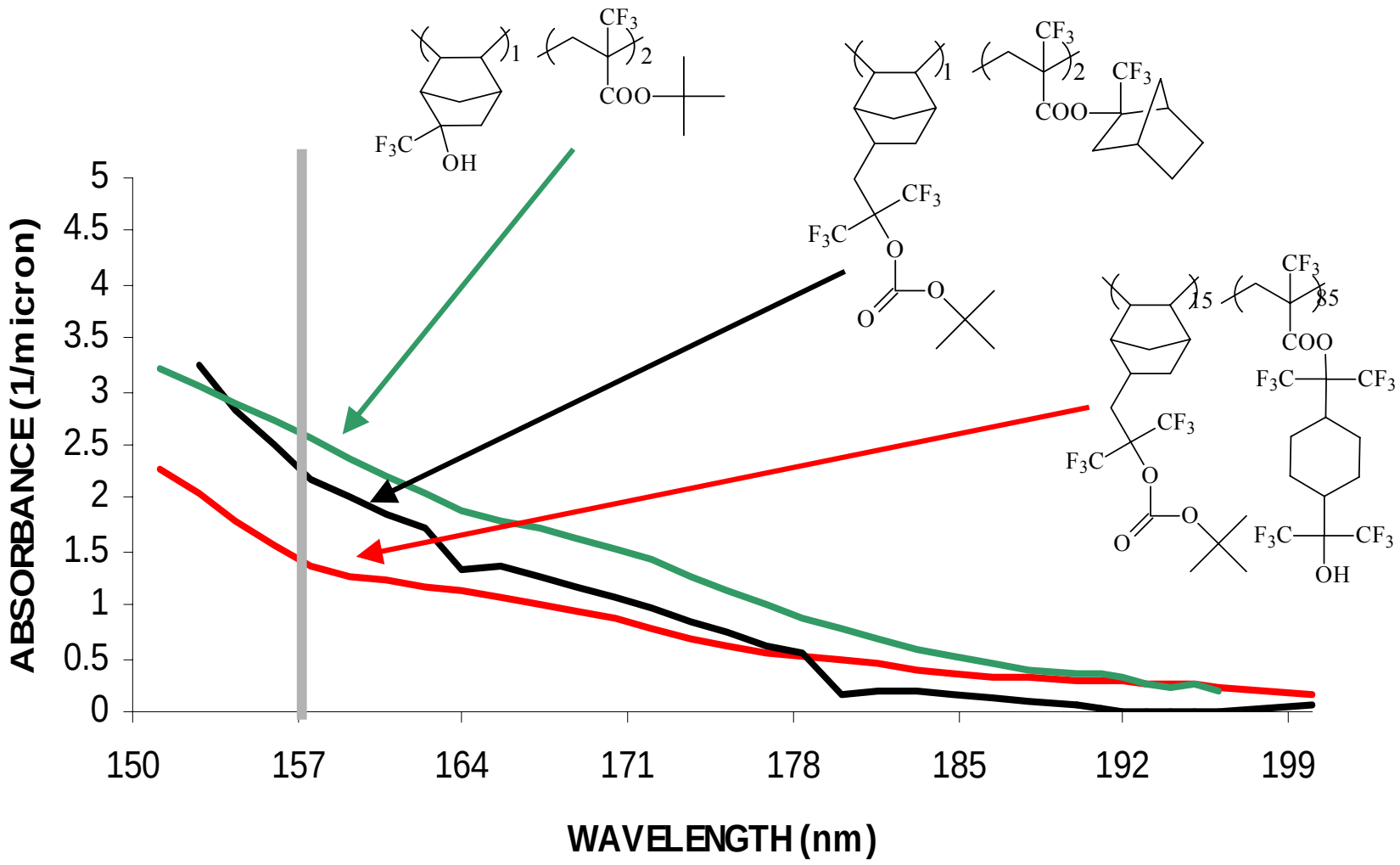


$M_w = 6{,}000$



$M_w = 19{,}000$

VASE Spectroscopy



T_g Measurements

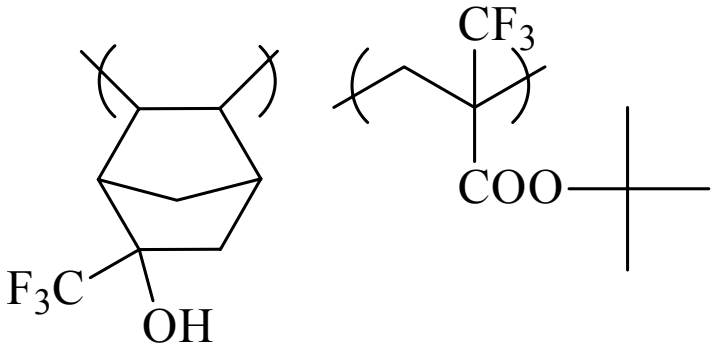
We've employed:

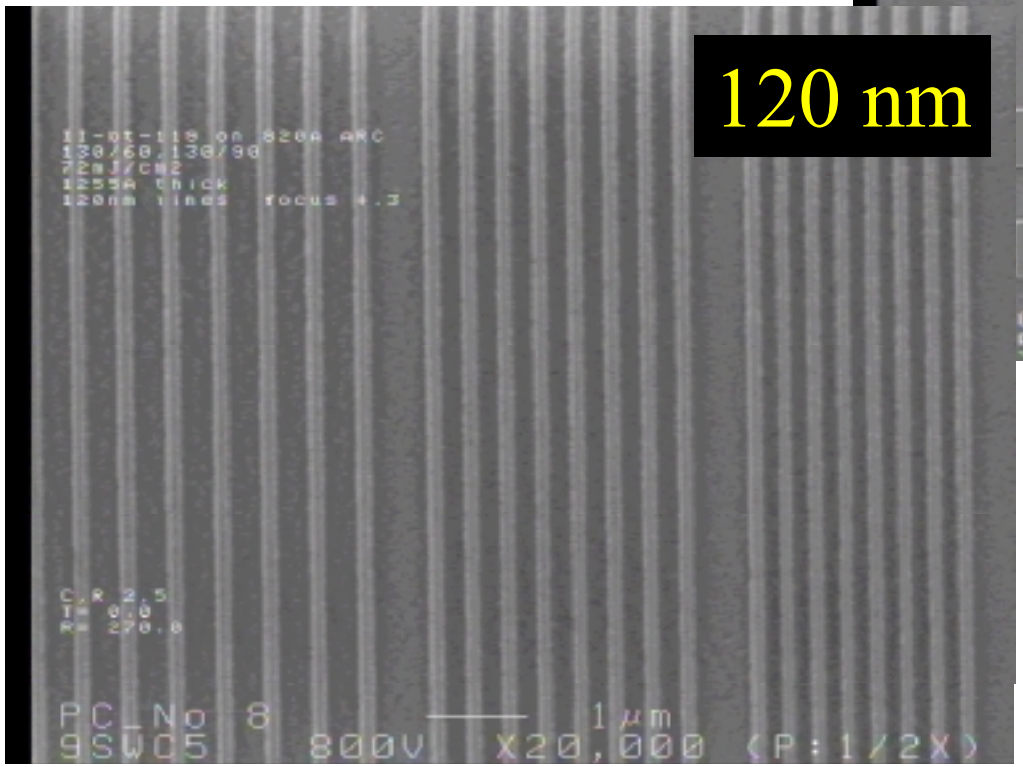
- Differential Scanning Calorimetry (DSC)
- Ellipsometry (UT, IBM)

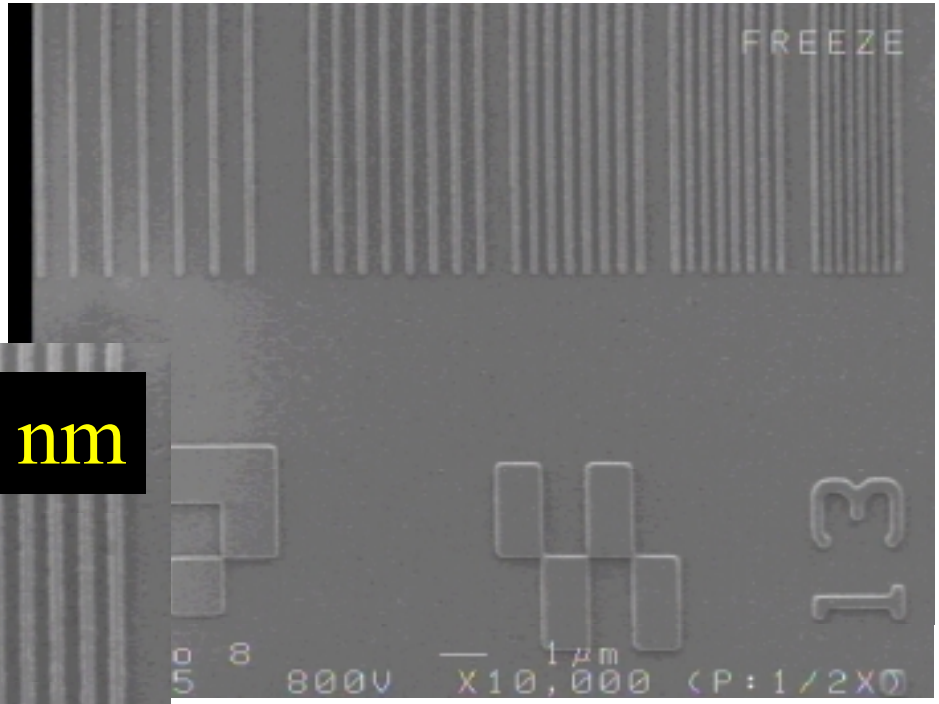
→ No glass transition??

Continuing investigations…

Preliminary 157 nm Imaging Studies



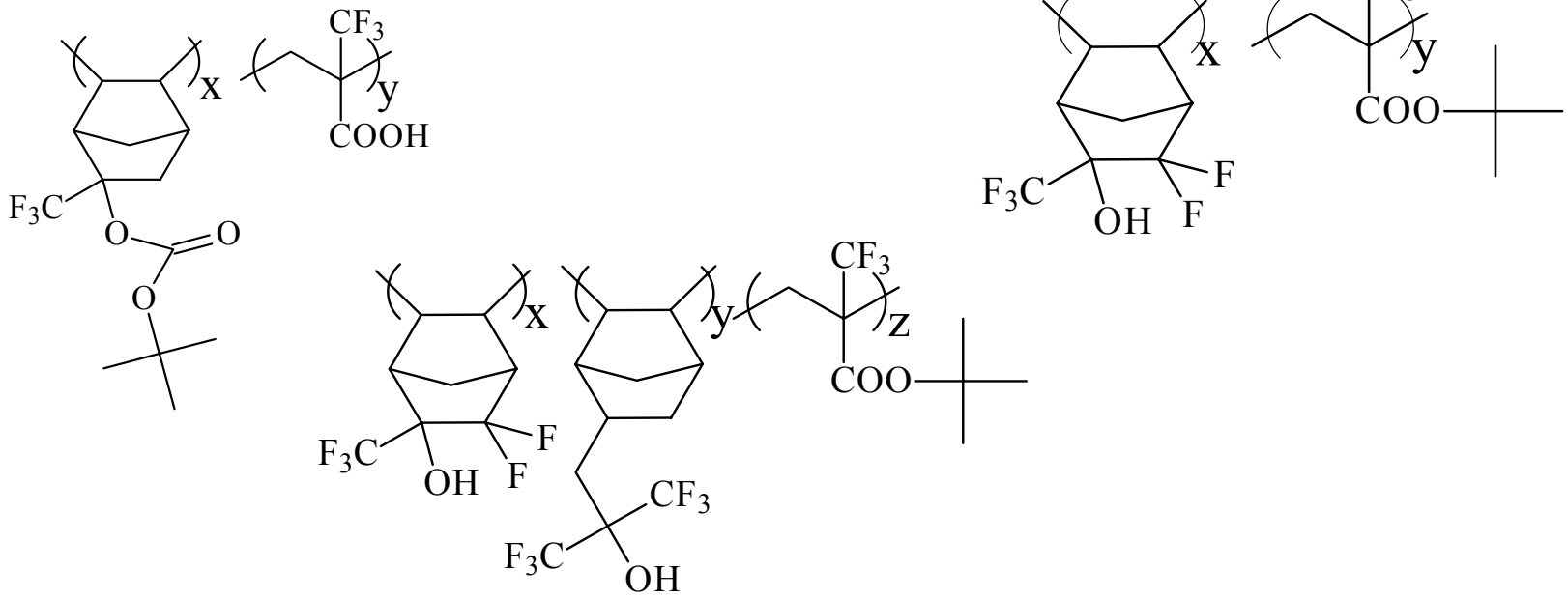




84.7% polymer, 15% TPS-Nf, .3% TBAH
157 nm exposure (0.6NA-0.3σ, 74mJ/cm^2), binary mask, 125 nm thick on 82 nm of ARC, 130˚C-60s PAB, 130˚C-90s PEB, 60s development (0.26N TMAH)

Future Work

- Improve base solubility/transparency of 2-TFMacrylate/norbornane copolymers



- Continue to improve imaging process for existing co-polymers
- Continue DI studies
- Explore alternative T_g measurement techniques

Acknowlegements

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- Jennifer Wunderlich
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- Georgia Rich

Central Glass

Clariant

SEMATECH