Norbornene-Carbon Monoxide Copolymerization & Dissolution Inhibitor Study

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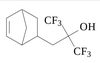
Introduction:

Several approaches have been investigated for polymerizing norbornene derivatives as 157 nm photoresist as these derivatives provide good etch-resistance properties. Carbon monoxide copolymerization is one of those approaches. This polymerization can provide two forms, ketal form and ketone form. Ketone form was explored to modify the ketone. However, the reactions were not successful. In this presentation, we show the carbon monoxide copolymerization in ketal form as a platform of 157 nm photoresist. We also show dissolution inhibitor study of the polymers including small molecules.

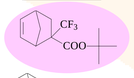
Carbon Monoxide Copolymerization

Low Absorbance Monomers of Choice

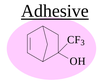
Alkaline soluble



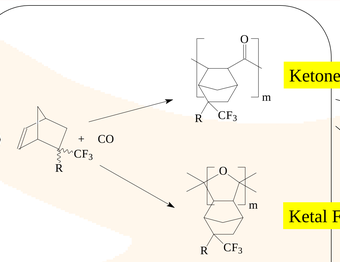
Acid labile



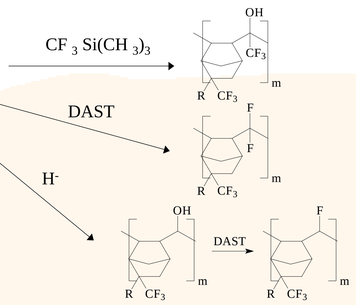
Adhesive



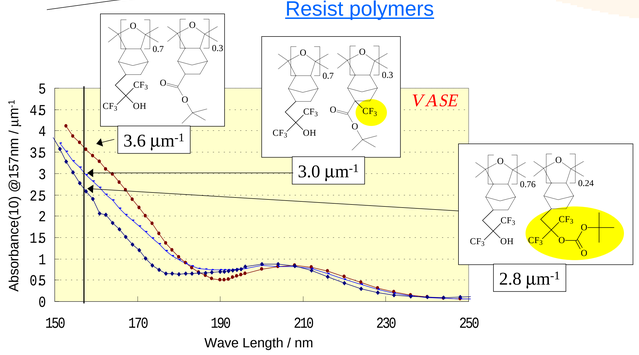
Monomers that cannot be incorporated by vinyl addition



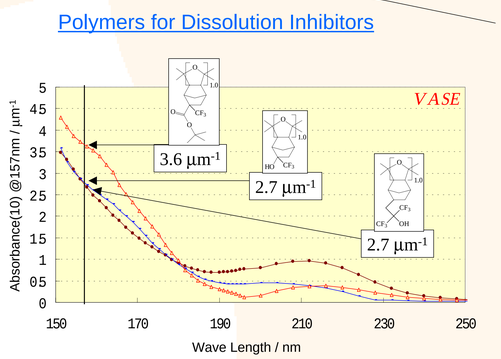
Modification of Polyketones



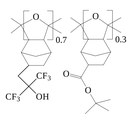
Resist polymers



Polymers for Dissolution Inhibitors



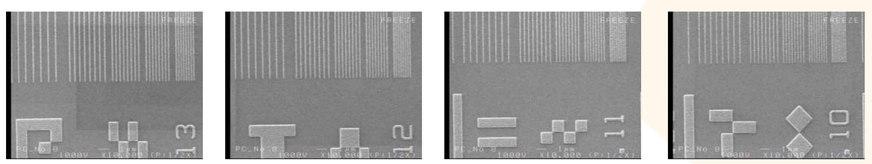
Mw 1600



High contrast, High resolution, No swelling, No residues

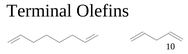
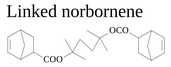
Severe line edge roughness

We need higher molecular weight !!



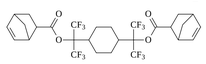
0.13 μm | 0.12 μm | 0.11 μm | 0.10 μm

Addition of Cross Linker to Raise Mw

Terminal Olefins		No cross linking Too little cross linking
Cyclic Diene		Hard to control Mw Too much cross linking
Linked norbornene		Mw 6000 Just Right !

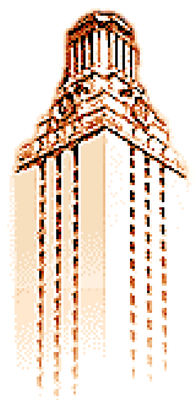
Future Work

- Scale up higher Mw polymers for imaging.
- Synthesize more transparent cross linkers.



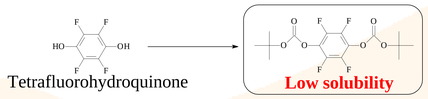
etc.

- Continue imaging work.
- Explore utility as dissolution inhibitors.

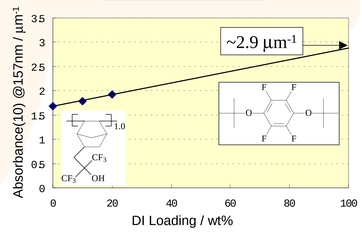


Dissolution Inhibitor Study

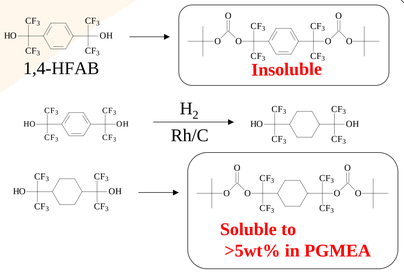
Tetrafluorohydroquinones



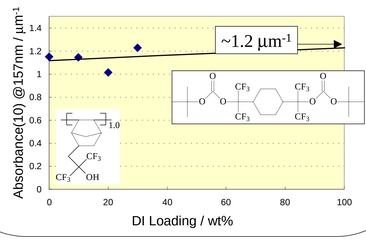
Absorbance of DI



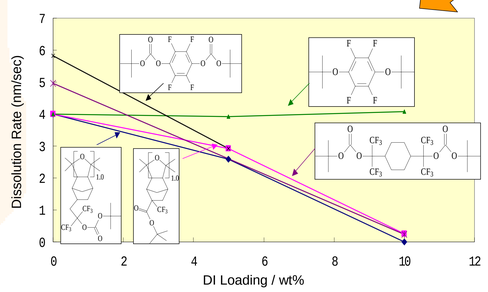
1,4-HFAB derivatives



Absorbance of DI



Dissolution Inhibitor Test

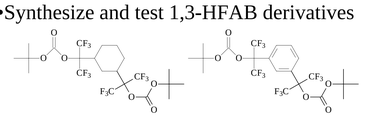


Summary

Dissolution Inhibitor	Solubility	Inhibition	Absorbance
	☺	☺	😐
	☺	☹	😐
	😐	☺	N/A
	☹	N/A	N/A
	☺	☺	☺

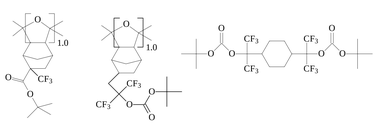
Future Work

- Synthesize and test 1,3-HFAB derivatives



- Explore other dissolution inhibitor structures.

- Test CO-copolymers and HFAB derivatives for imaging as DIs.



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