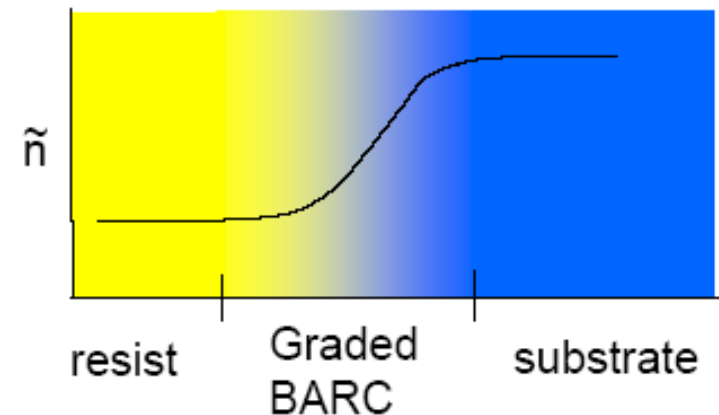
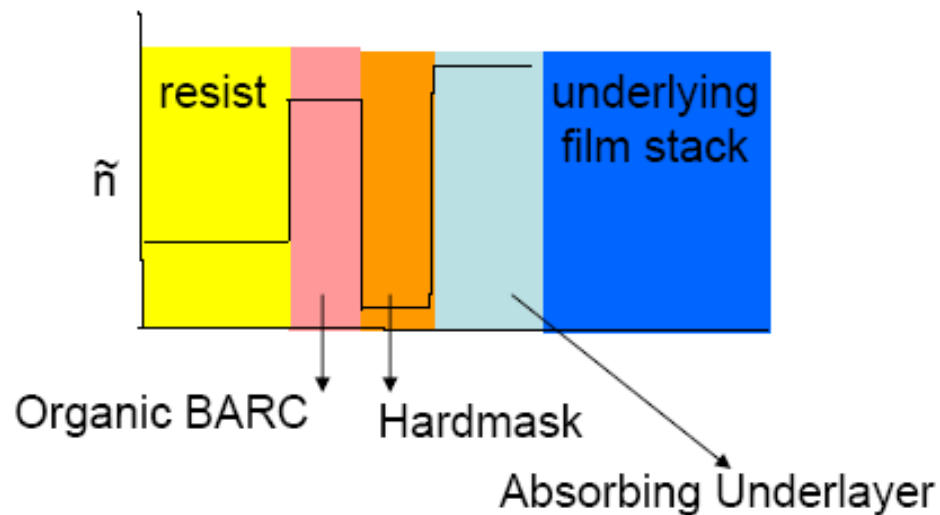


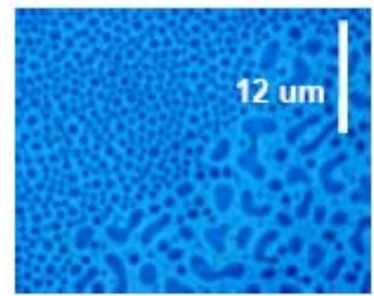
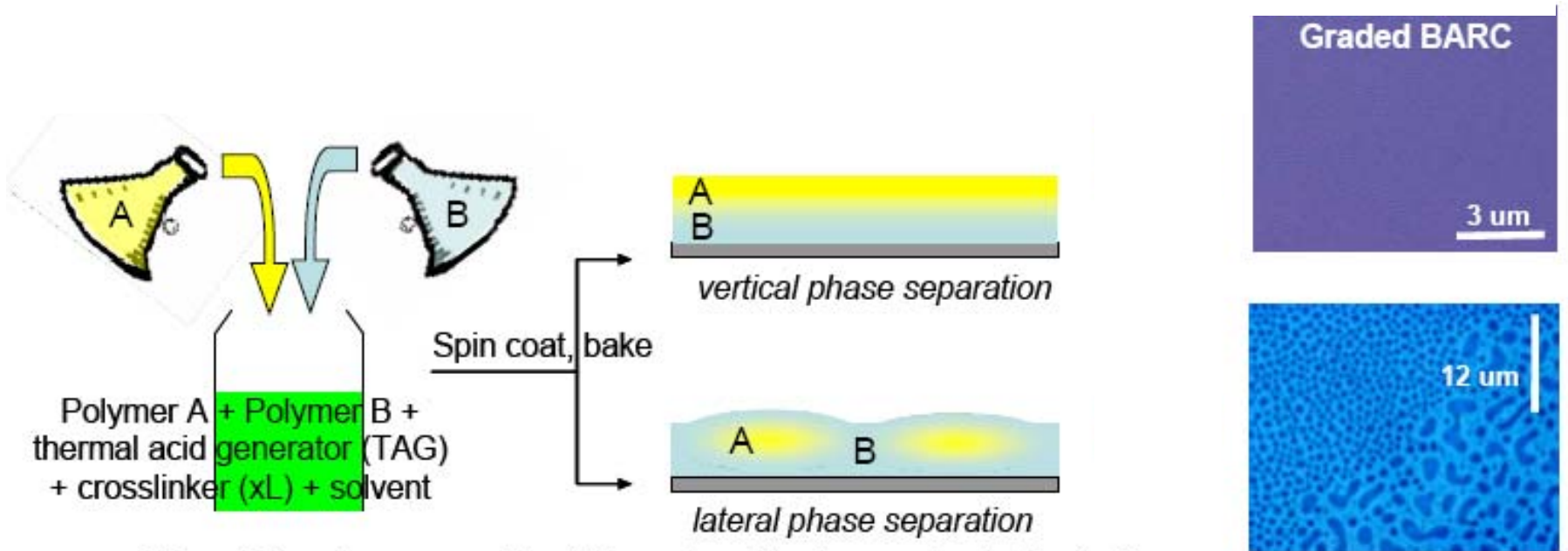
# GBARC Development for High NA

## Spin-on Graded Bottom Antireflective Coating

- Reflectivity Control Schemes at High NA
  - Low reflectivity is imperative for CD swing control, standing wave elimination and reflective notching.
  - minimization of CD variation
- Reflectivity Control degrades with index-mismatched imaging layers



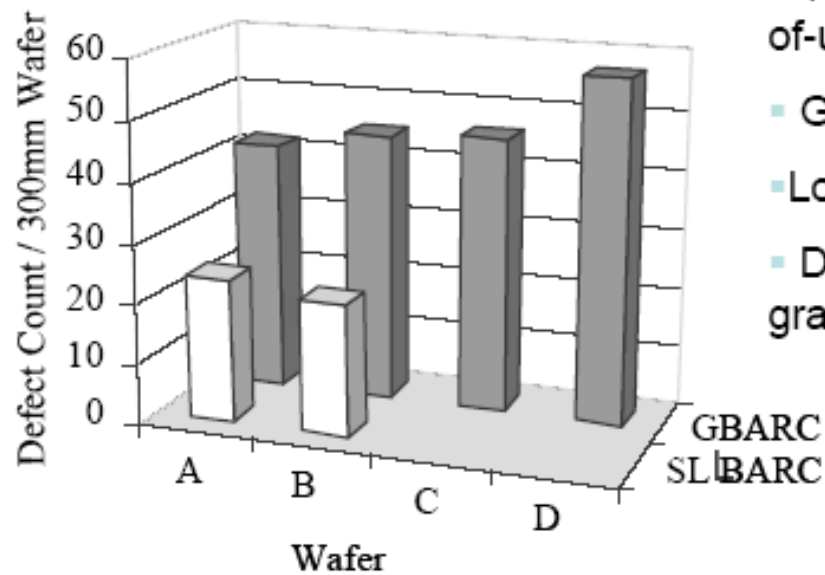
# Spin-on graded BARC (GBARC) – Concept



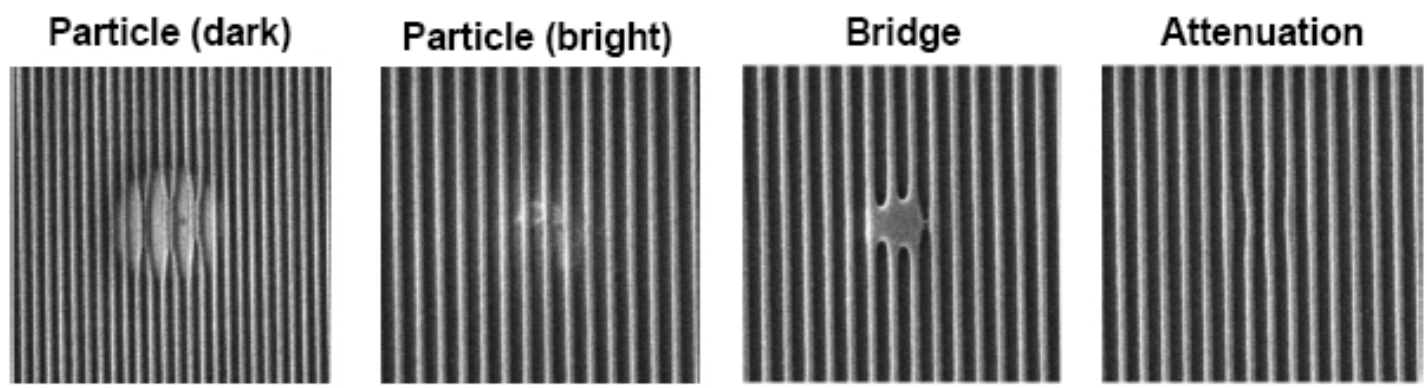
optical microscope view

- Blend 2 polymers with different optical constants/polarity
- Induce vertical phase separation during the BARC coat/bake steps
- Driving force for interfacial structure formation:
  - Polymer-Polymer immiscibility
  - Polymer-Substrate Interactions (wettability)
  - Differential surface energy of polymer components

# GBARC – Post-Patterning Defect Count

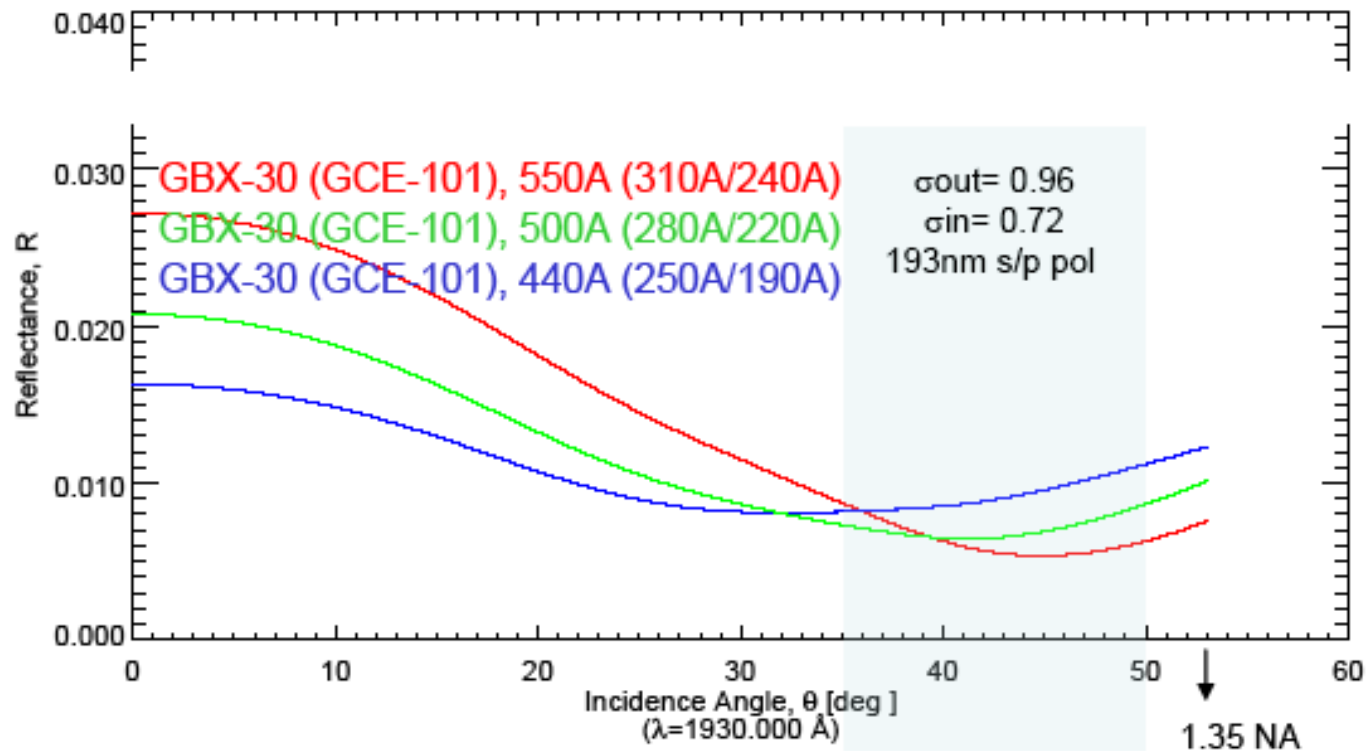


- Track-dispensed GBARC and SL BARC with point-of-use filtration ((Nylon filter, 0.040 micron pore size)
- GBARC 65nm; SL BARC 60nm thick
- Low defectivity detected after patterning w/ GBARC
- Defects are not related to phase separation (optical gradient registration achieved across 300 mm wafer)
- Only 2x larger defectivity compared to commercial SL BARC, after short track recipe optimization work.



100nmL/S, grating reticle – 0.93 NA ArF Immersion

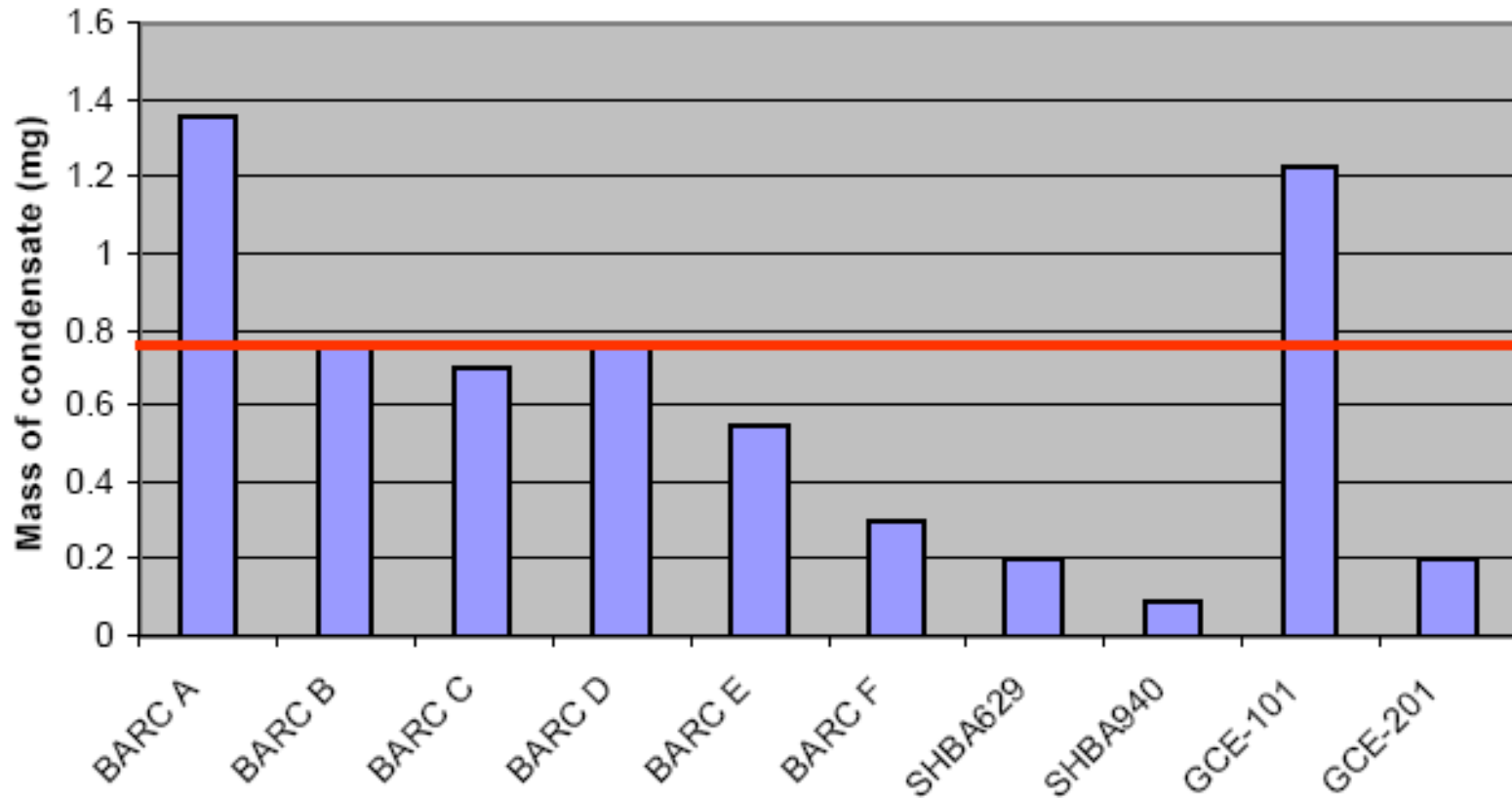
## GCE-101 Reflectivity



- GBX-30 500A provides lower Reflectivity in the range of angles of interest, compared to GBX-30 440A.
- GBX-30 440A has more uniform reflectivity control through the full angle window (0.0 - 1.35 NA) compared to GBX-30 500A

# Outgassing Measurements

## BARC Outgassing Summary



• The issue is outgassing.

# Summary and future work

		reflectivity	DOF	Profile	Collapse	Outgassing	Etching
120nm 2073	BARC		OK	Bad	OK	OK	OK
	GCE-101	Good	OK	Good		Fail	OK
120nm 3230	BARC		OK	footing	OK	OK	OK
	GCE-101	Good	OK	OK	Maybe OK	Fail	OK
120nm 2160	BARC		OK	footing	OK	OK	OK
	GCE-101	Good	OK	OK	OK	Fail	OK

- GCE-101 provides better reflectivity control than BARC. Resist profile is vertical on GCE-101 and footing on BARC. It could be the reason that GCE-101 has more resist collapse.
- Process window on GCE-101 is comparable to that on BARC.
- The issue of Gen 3 is outgassing. We're working on better outgassing methodology and possible formulation optimization.
- Gen 3.5 is under development for better etching performance.
- We're also developing various top polymer for easy mass production for Gen 3 and Gen3.5.