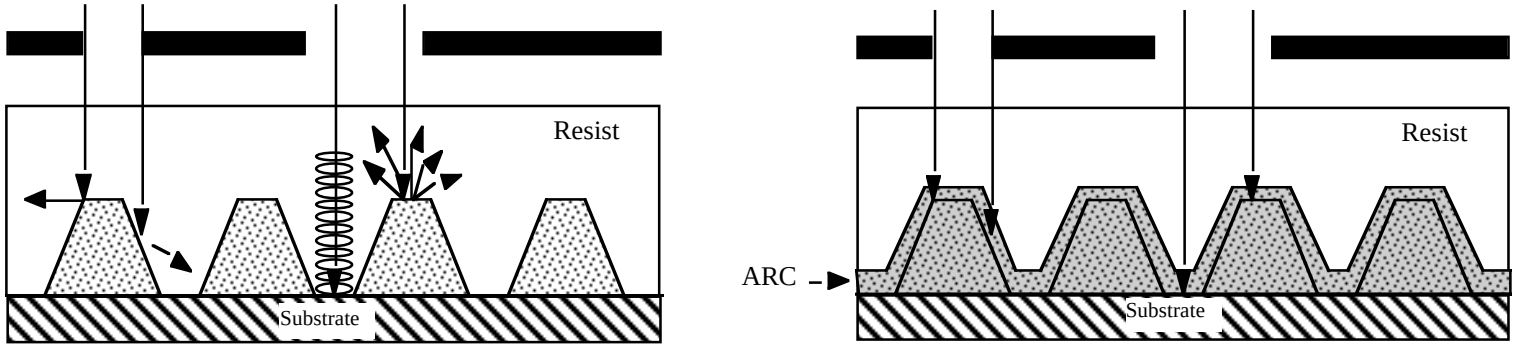
ARC® XL Series

Broadband
g-line & i-line
Anti-Reflective Coatings

TECHNOLOGY TO BUILD ON

Brewer Science Inc., Rolla Mo, USA

Why Use a Brewer Science ARC?



Without Brewer ARC

With Brewer ARC

Lithography Reflective Problems In Photoresist Without Brewer Science ARC

Reflective Notching
Standing Wave Effects

Back Scattered Light
Loss of CD Control

How ARC Enhances Your Process

ARC Performance Results

Eliminates Reflective Notching

Eliminates Standing Waves & Scattered Light

Maximizes Photoresist Exposure Latitude

Increases Stepper Focus Latitude

Key Results

Extends Overall Lithography Process Window

Increased CD Control

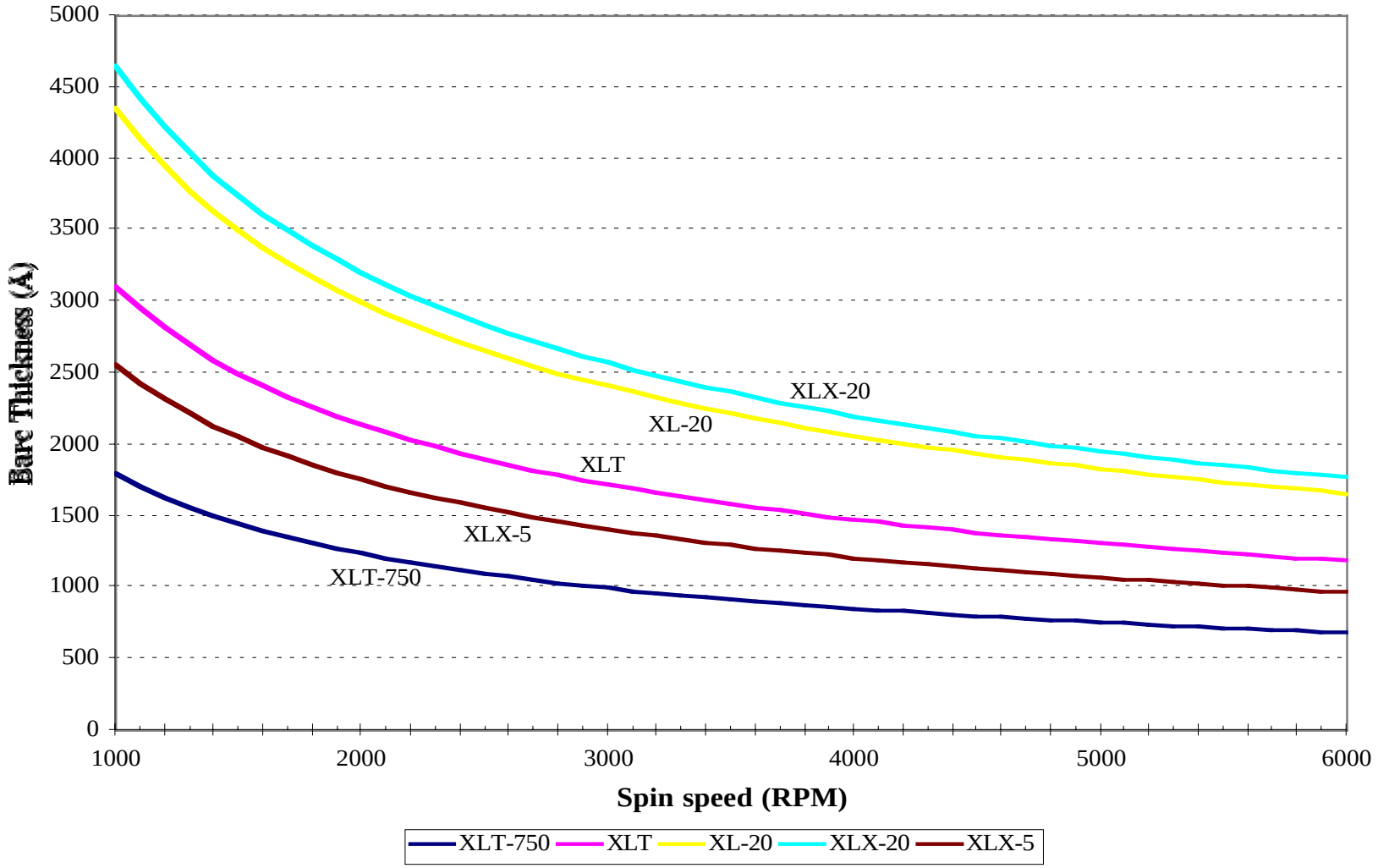
Maximizes Process Control

Increases Usage Life of Stepper

XL Characteristics

- Absorbance at 436nm and 365nm
- Develops away with resist in one easy step
- Hard baking allows removal by dry etch process
- Typically requires separate coater and drain systems
- Bake temperature controls ARC solubility in developer
- Eliminates need for HMDS

XL Family Spin Speed Curves



ARC XL Family

Thickness Measurement

Prometrix Setup

N1 = 1.8376 E+000

N2 = - 1.0183 E+007

N3 = 3.7146 E+014

wavelength min = 550 nm

wavelength max = 800 nm

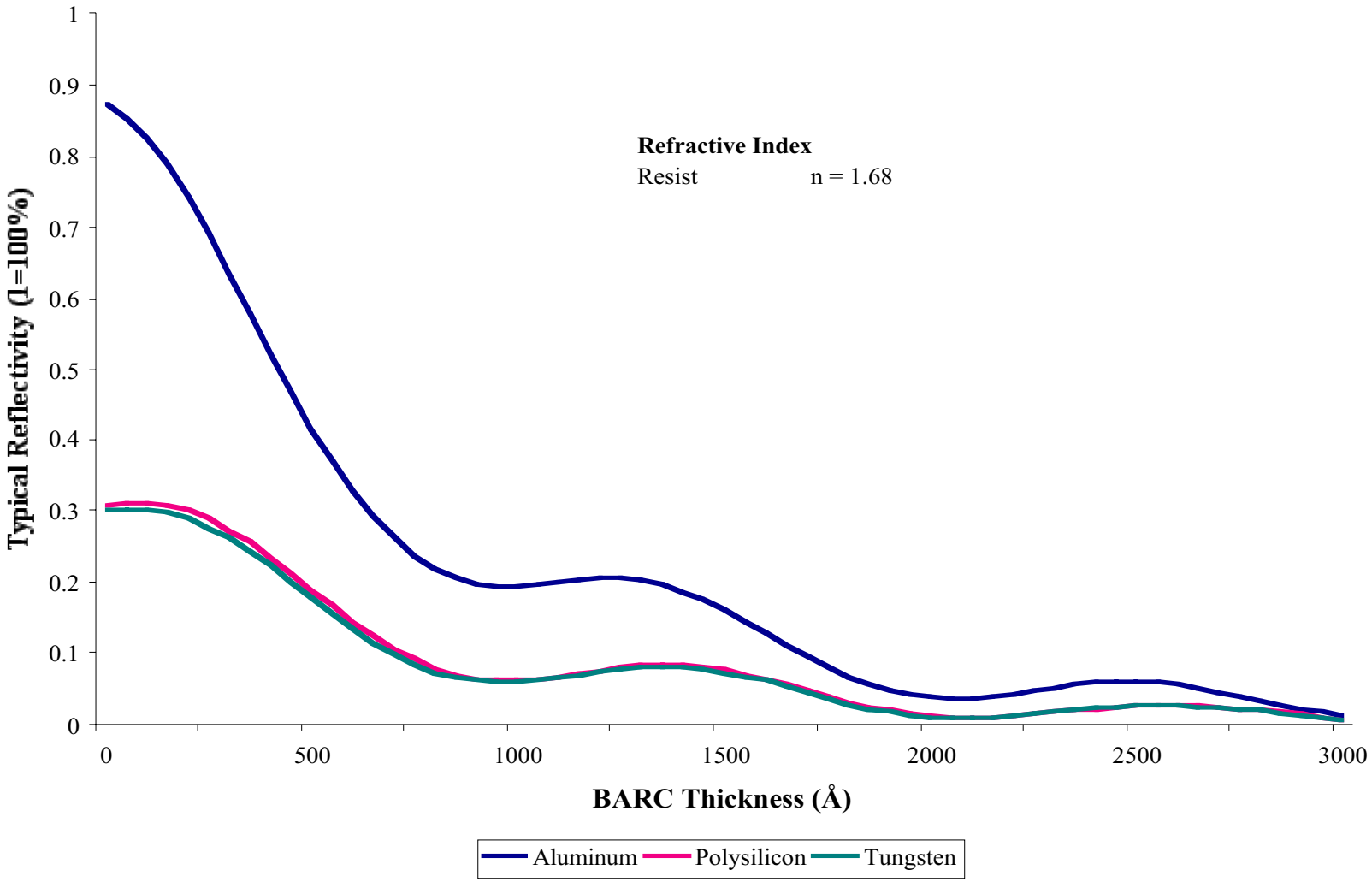
Ellipsometer

λ = 632 nm

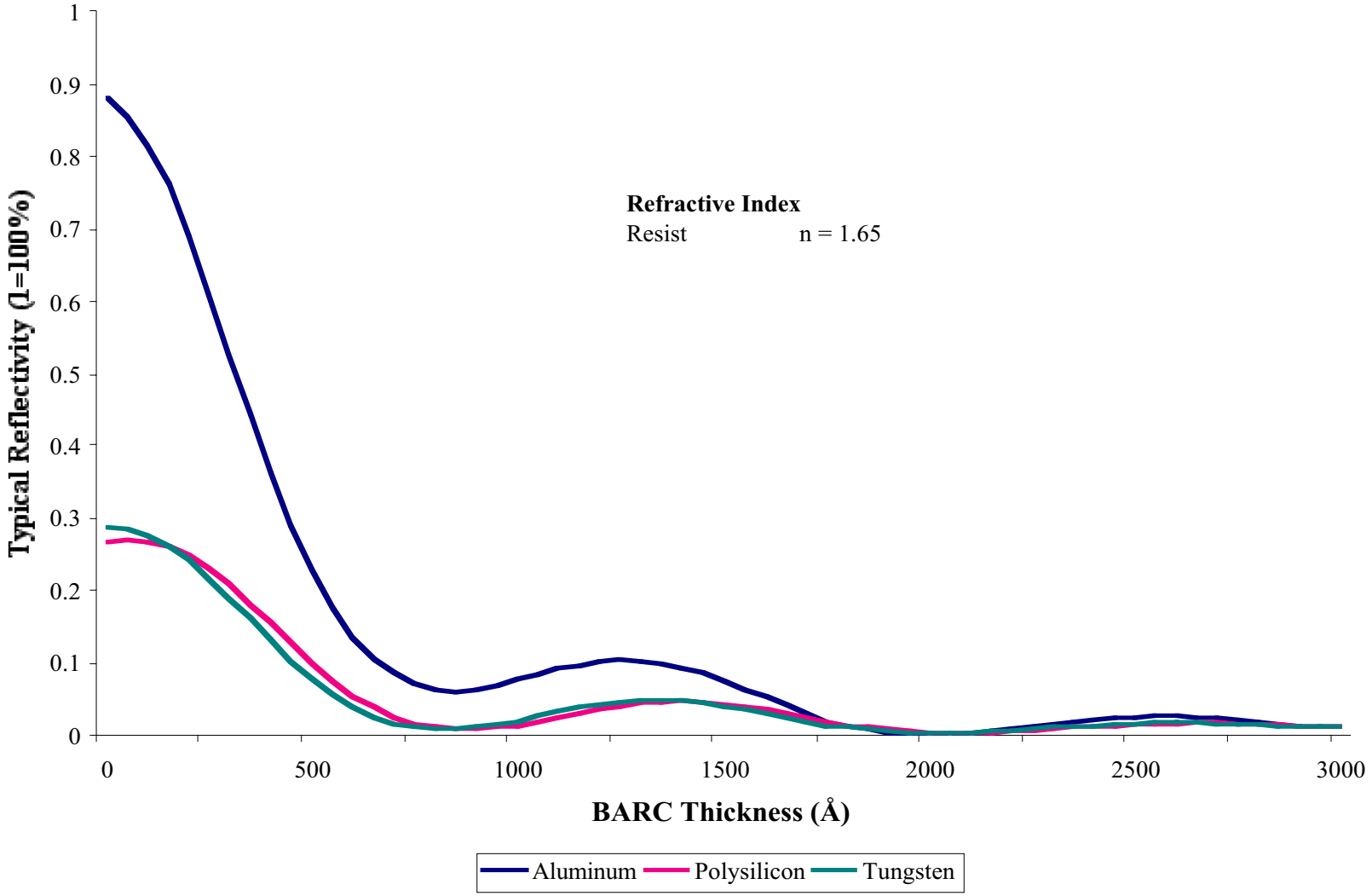
n = 1.75

k = 0.00

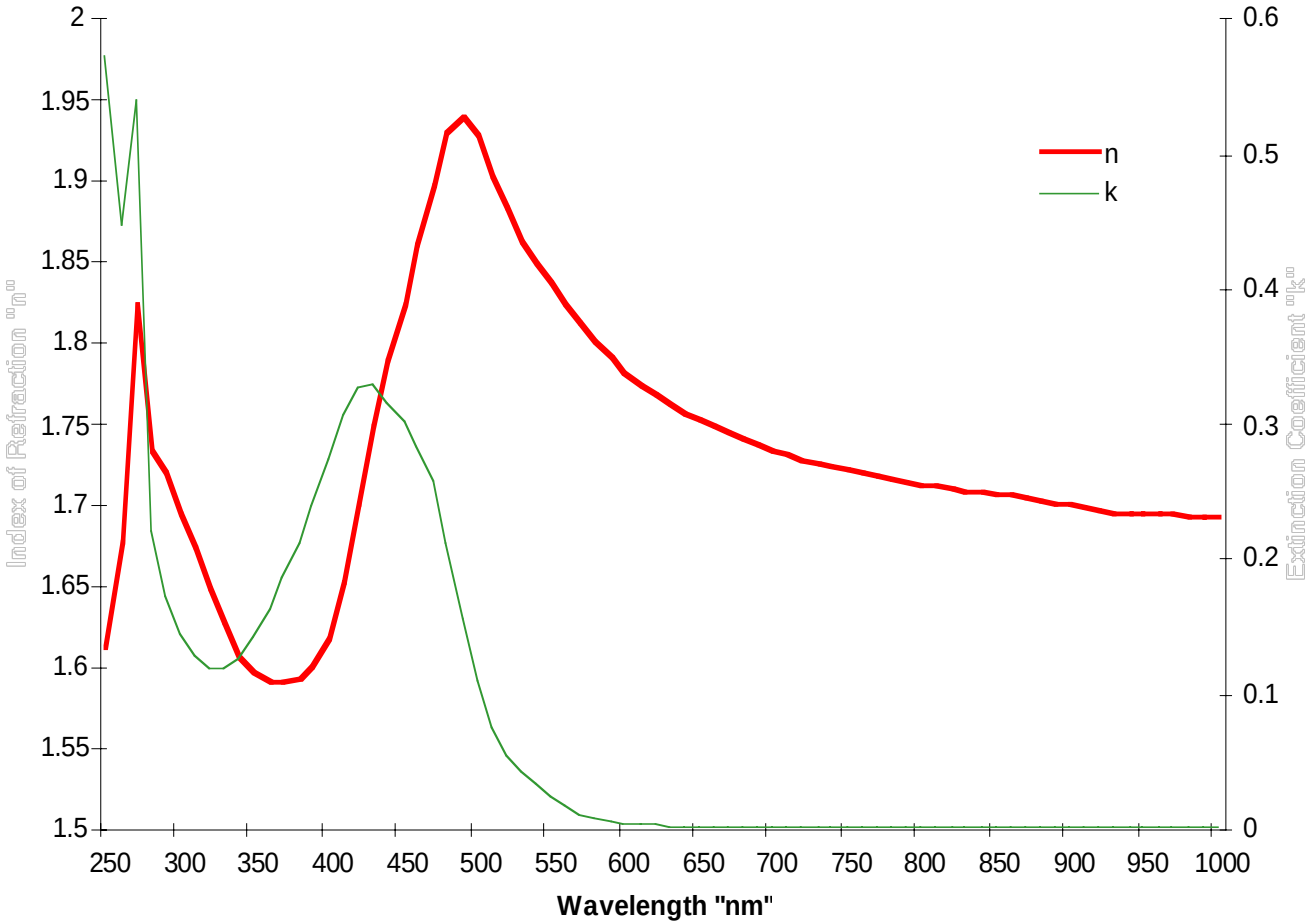
XL Series Reflectivity Curves at i-line



XL Series Reflectivity Curves at g-line



Typical Optical Data



XL Series Optical Properties

Exposure Wavelength	XLT Family		XLX Family	
	n	k	n	k
g-line	1.74	0.34	1.79	0.32
i-line	1.61	0.18	1.61	0.18

XL Processing

Wet Developable

Lower bake of 168 to 17X

2 stage bake required for XLX-20

<.26 N developer for XLT-750 & XLT

>.26 N developer for XLX-5 & XLX-20

Extra develop and rinse time may be necessary for XLX-20

Dry Etch

Hard bake at > 190°C

2 stage bake required for XLX-20

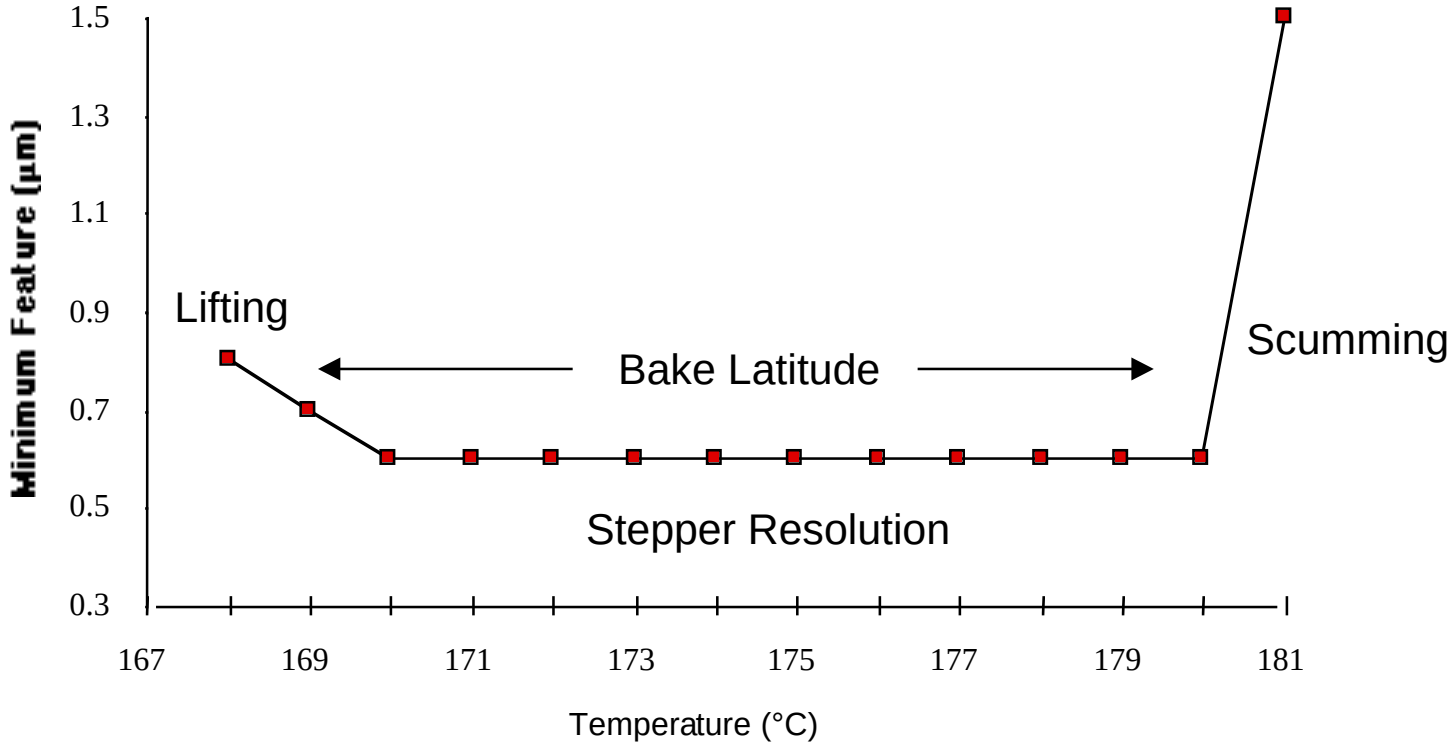
Use dry etch process to remove ARC

XL Processes

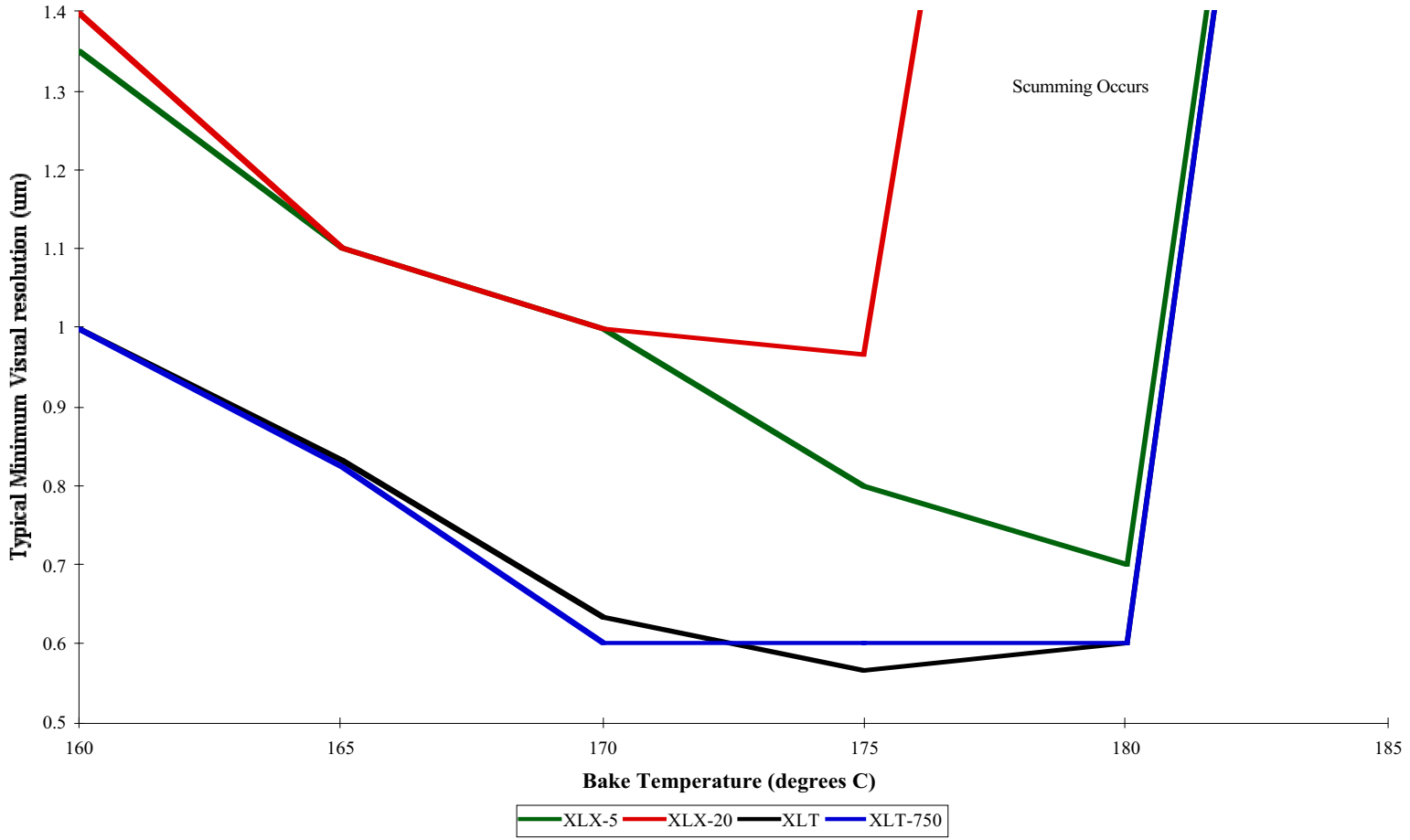
XLT-750	(750Å)	
	Spin Speed	5000 rpm / 60 sec
	Hotplate Bake	168°C / 60
XLX-5	(1400Å)	
	Spin Speed	3000 rpm / 60 sec
	Hotplate Bake	168°C / 60
XLT	(1300Å)	
	Spin Speed	5000 rpm / 60 sec
	Hotplate Bake	168°C / 60
XLX-20	(2350Å)	
	Spin Speed	3500 rpm / 60 sec
	Hotplate Pre Bake	100°C / 60
	Hotplate Final Bake	168°C / 60

Example Bake Window

ARC® XLX-20 (2200Å) + Shipley SPRT 518 (2.0µm) i-line
Dose=1.15 sec. Developer= 70 sec. CD26 (TMAH 0.26N).



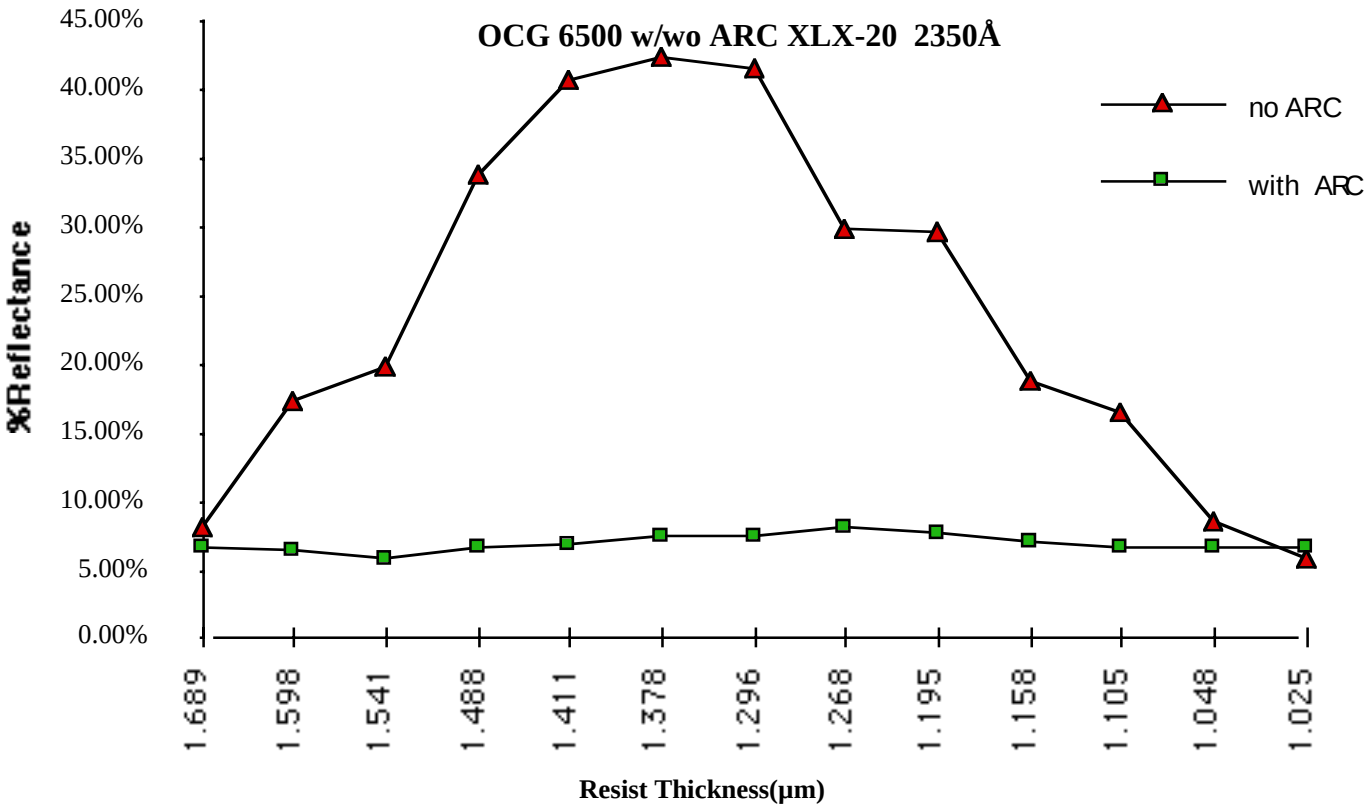
Bake Window for Selected XL Series Products



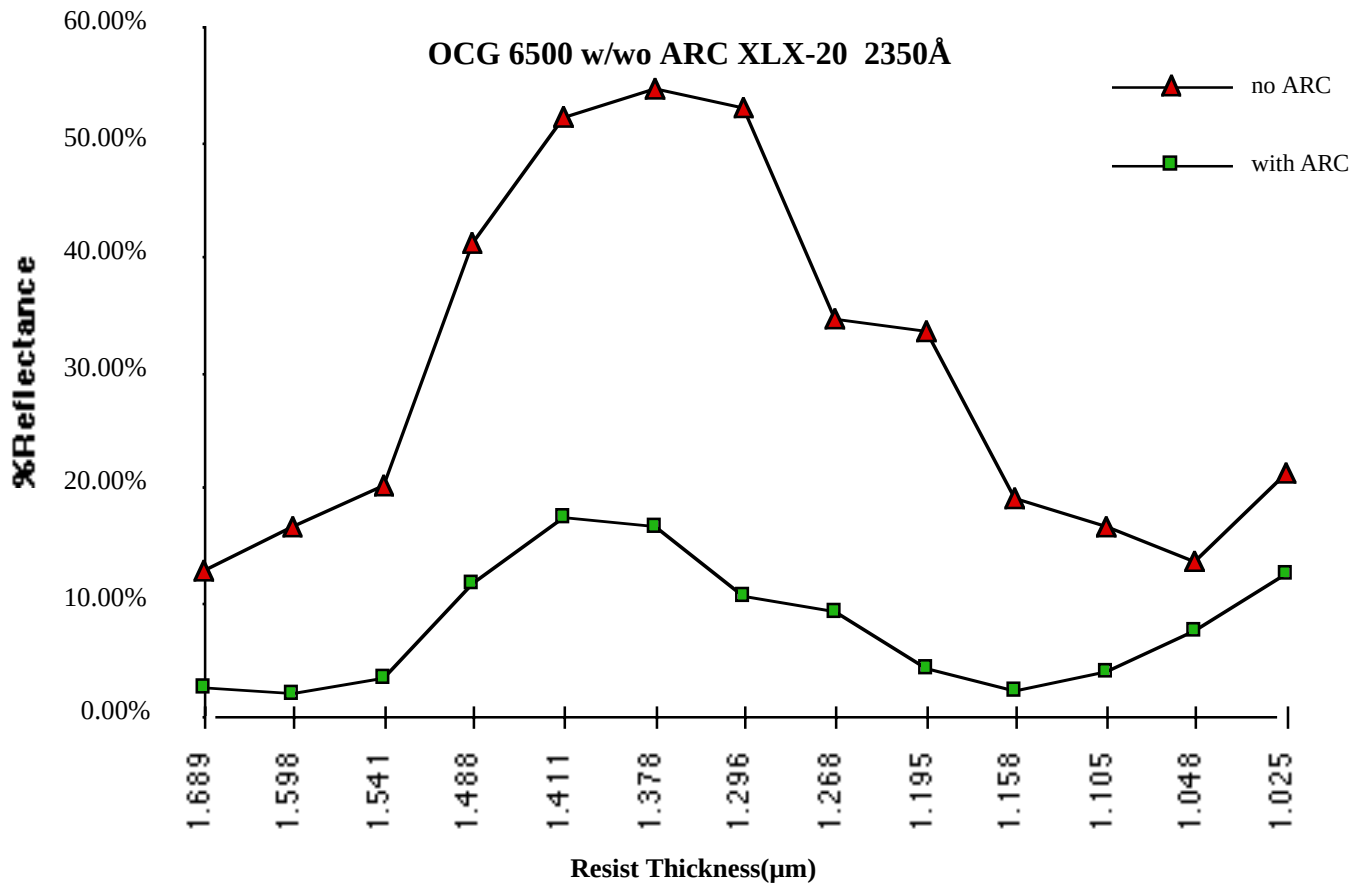
Applications

- Poly level
  - ARC® XLT-750
  - ARC® XLT
- Metal applications
  - ARC® XLX-20
- Contacts / Via
  - ARC® XLX-20
- Lift Off
  - All
- SAW Devices
  - ARC® XLT-750
  - ARC® XLT

XLX-20 Swing Curve (g-line)

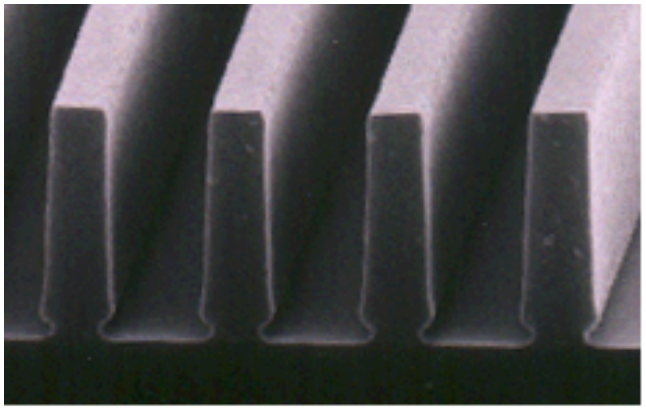


XLX-20 Swing Curve (i-line)

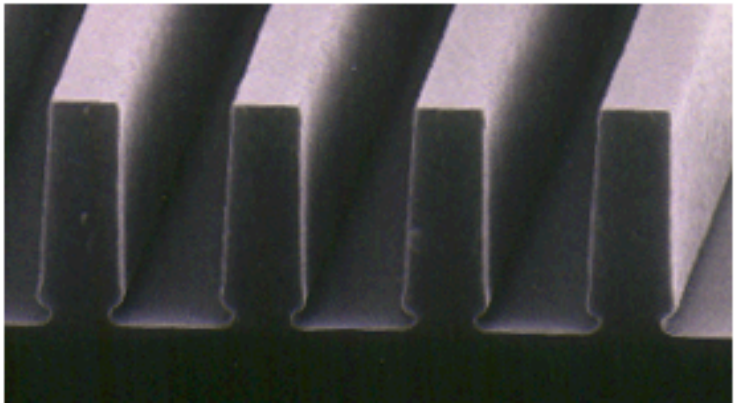


XLX-5 Profiles (i-line)

ARC XLX-5 (1300Å) w/ JSR IX500 (1.4µm)
350 mJ .53 NA stepper



0.5 µm



0.7 µm

Edge Bead Removal

EBR Process using Brewer Science's EBC:

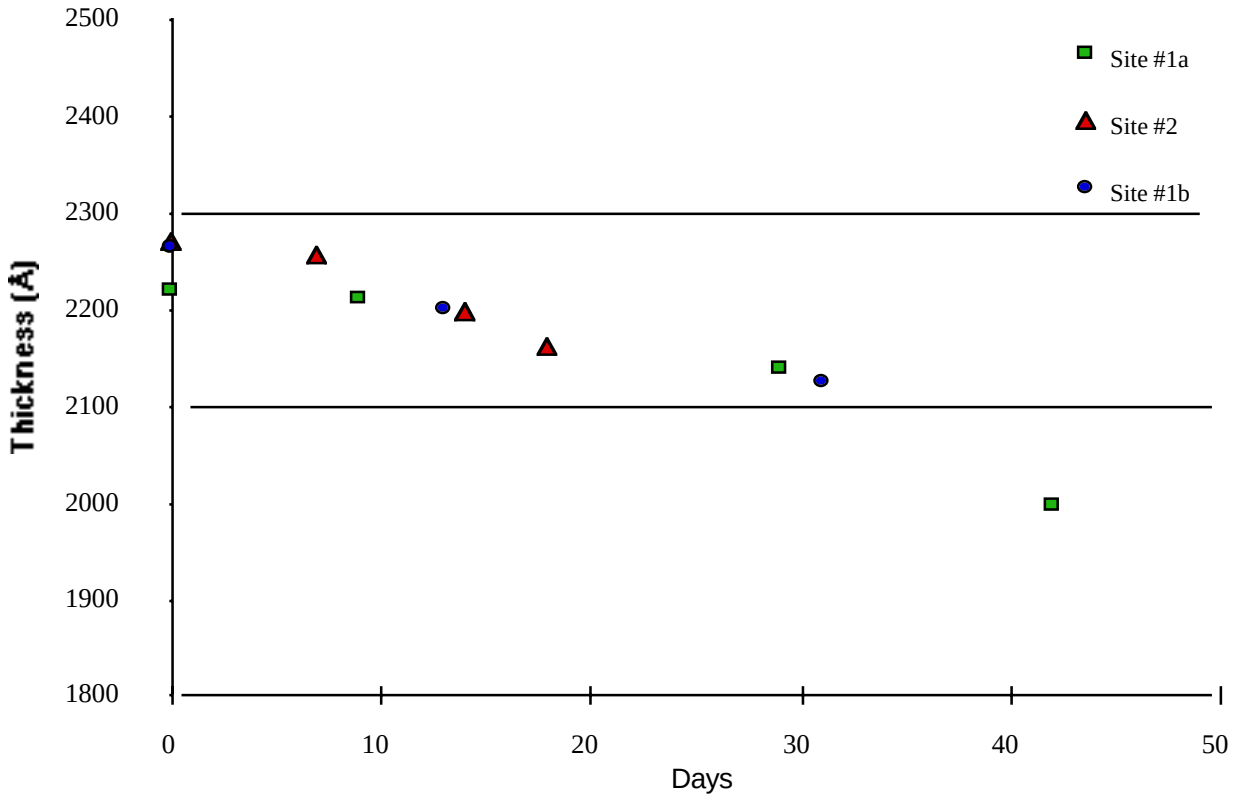
1. Dispense Arm Position - approx. 3 mm in from edge. Dispense EBC for 6 secs.
2. Dispense Arm Position - retracted to home position, continue spinning for 5 secs.
3. Dispense Arm Position - approx. 2.5mm in from edge. Dispense EBC for 6 secs.
4. Dispense Arm Position - retracted to home position, spin for 5 sec.

All steps were done with a spin speed of 2000 rpm except the final spin which was done at 3500 rpm. Final spin can be done at 2000 rpm but spin time will have to be increased till wafer is dry. Spin times and speeds may vary due to wafer size and environmental conditions.

Stripping the ARC

- O2 plasma strip ability
- Piranha and RCA cleans
- Stripped in organic strippers
  - (typically NMP based) with pH >10

XLX-20 Stability Data



ARC XLX Family Ion Analysis

		Detection Limit	ppb			Detection Limit	ppb
Aluminum	(Al)	0.1	21.0	Magnesium	(Mg)	0.1	5.2
Barium	(Ba)	0.1	0.2	Manganese	(Mn)	0.1	0.4
Beryllium	(Be)	1.0	<1.0	Molybdenum	(Mo)	0.5	2.9
Bismuth	(Bi)	1.0	<1.0	Nickel	(Ni)	0.1	0.5
Cadmium	(Cd)	0.1	0.1	Potassium	(K)	5.0	11.0
Calcium	(Ca)	3.0	27.0	Rubidium	(Rb)	0.1	<0.1
Cesium	(Cs)	0.1	<0.1	Silver	(Ag)	1.0	<1.0
Chromium	(Cr)	0.5	3.3	Sodium	(Na)	1.0	7.0
Cobalt	(Co)	0.1	0.4	Strontium	(Sr)	0.1	<0.1
Copper	(Cu)	0.5	4.9	Thorium	(Th)	1.0	<1.0
Gallium	(Ga)	0.1	<0.1	Tin	(Sn)	2.0	<2.0
Indium	(In)	0.1	<0.1	Titanium	(Ti)	1.0	18.0
Iron	(Fe)	3.0	18.0	Vanadium	(V)	0.1	<0.1
Lead	(Pb)	0.1	<0.1	Zinc	(Zn)	1.0	2.6
Lithium	(Li)	0.1	<0.1	Zirconium	(Zr)	1.0	<1.0