



P-NIL (Photo Nano-Imprint Lithography) Resins For Diffractive Optical Elements (DOE)

- Acrylate resins
- Spin-coating, Gravure Coating, Ink-jet
- Optically Clear
- Refractive index: 1.512 to 1.612 @ 589 nm
- UV-cure
- Easy to process

UV-NIL Resins

Photo-NIL Resins



Multi-Purpose P-NIL Resins

Resin	Viscosity (cps) at 25 °C	Tg (°C)	RI (25 °C, 589 nm) cured film
BD-400	750	145	1.512
IP-158	450	70	1.584
PR-1600-CA	400	89	1.600
PR-1612	1,800	60	1.612



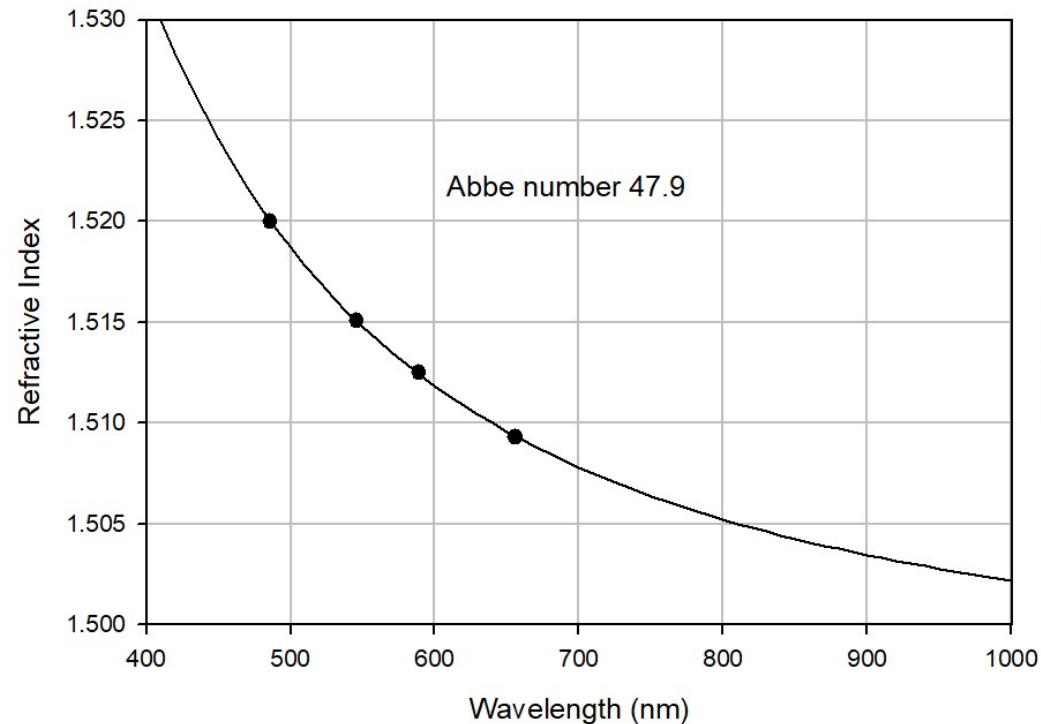
Refractive Index vs. Wavelength

(RI of Cured Films)

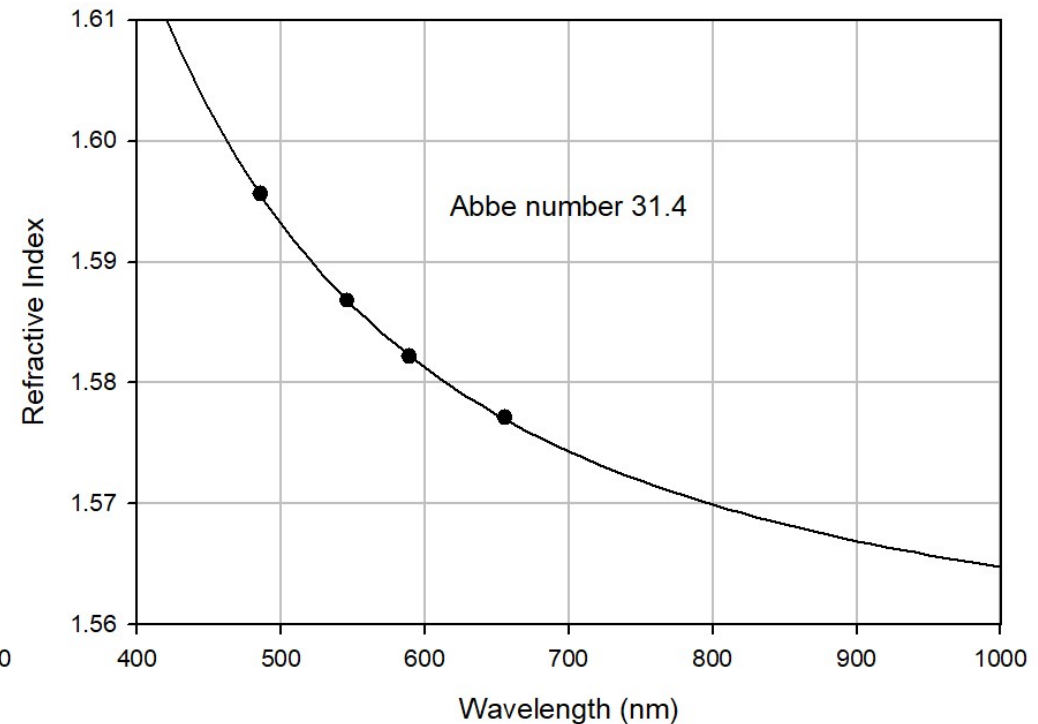
BD-400

IP-158

BD-400 Refractive Index at 25 °C



IP-158 Refractive Index at 25 °C





Refractive Index vs. Wavelength

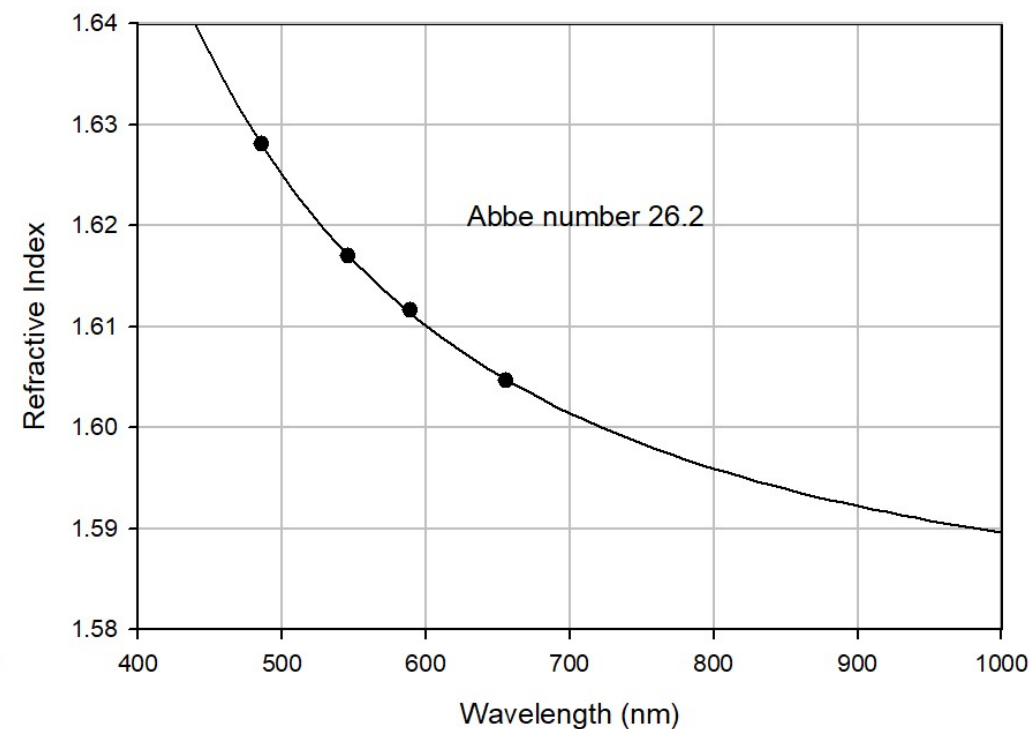
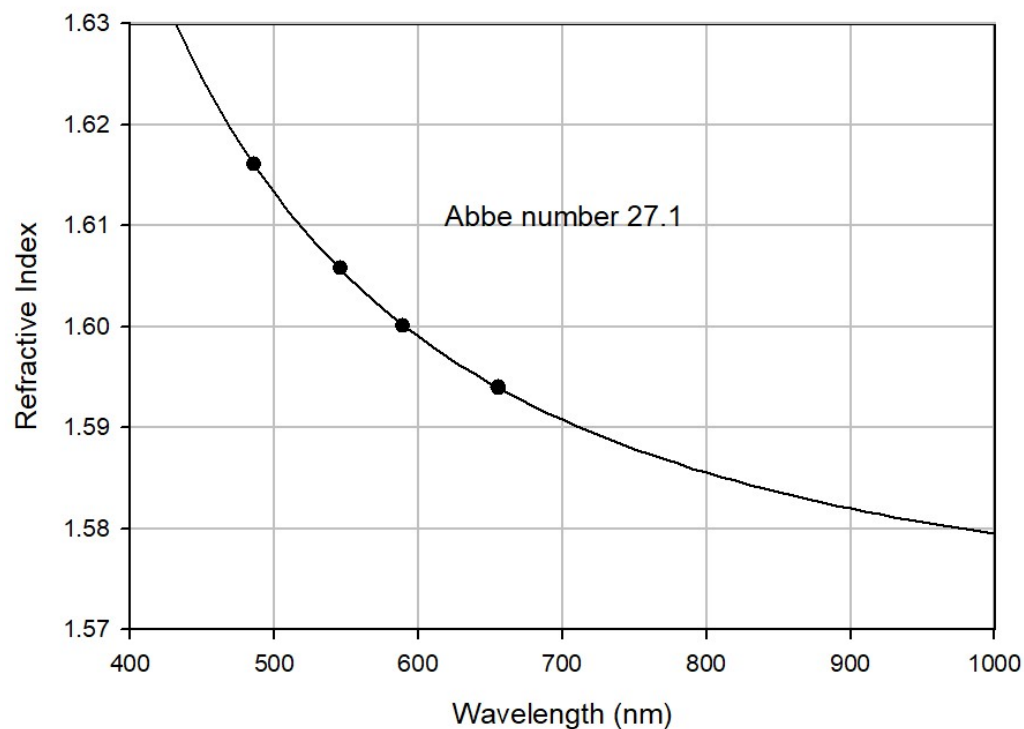
(RI of Cured Films)

PR-1600-CA

PR-1612

PR1600CA Refractive Index at 25 °C

PR1612 Refractive Index at 25 °C

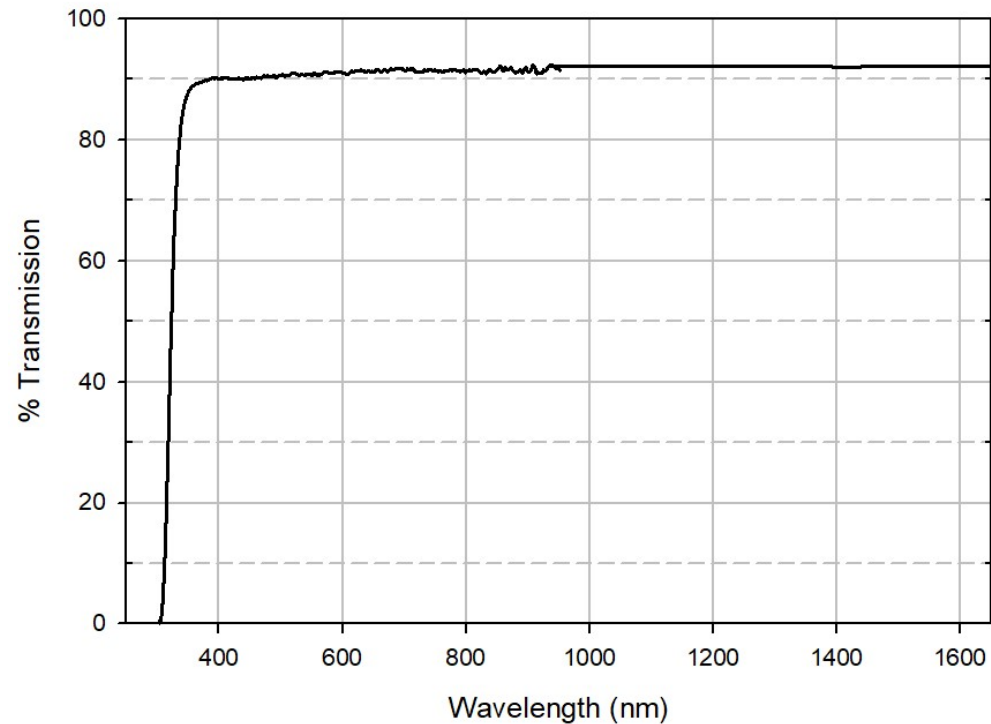




Optically Clear Films

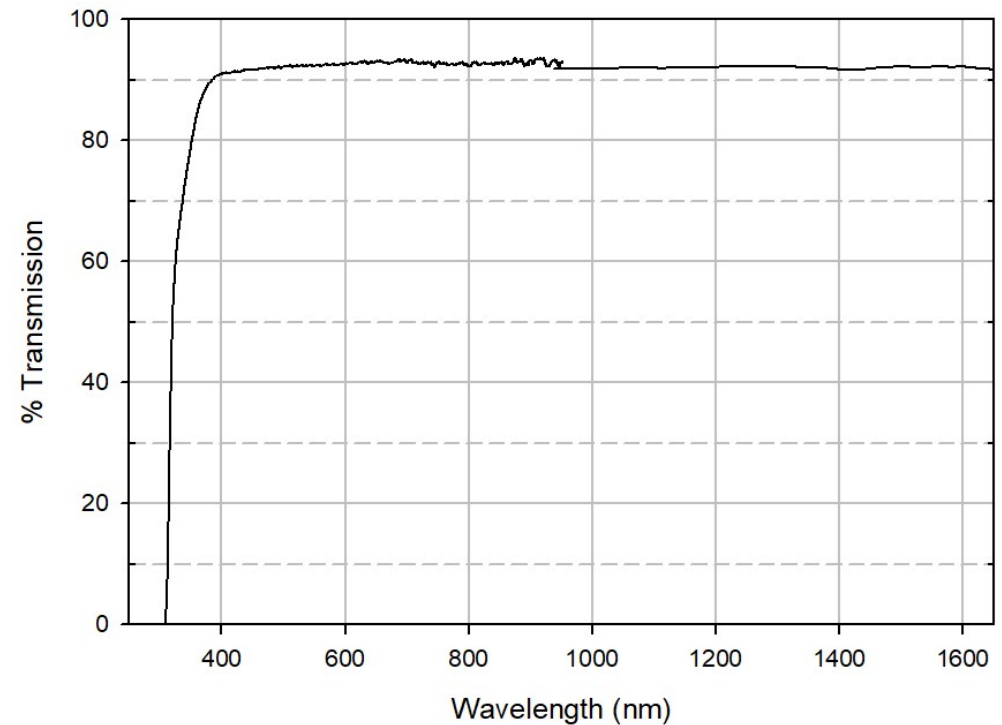
BD-400

BD400 100 micron film on glass
air reference, no correction for surface reflection



IP-158

IP158 75 micron film on Gorilla Glass
air reference, no correction for surface reflection

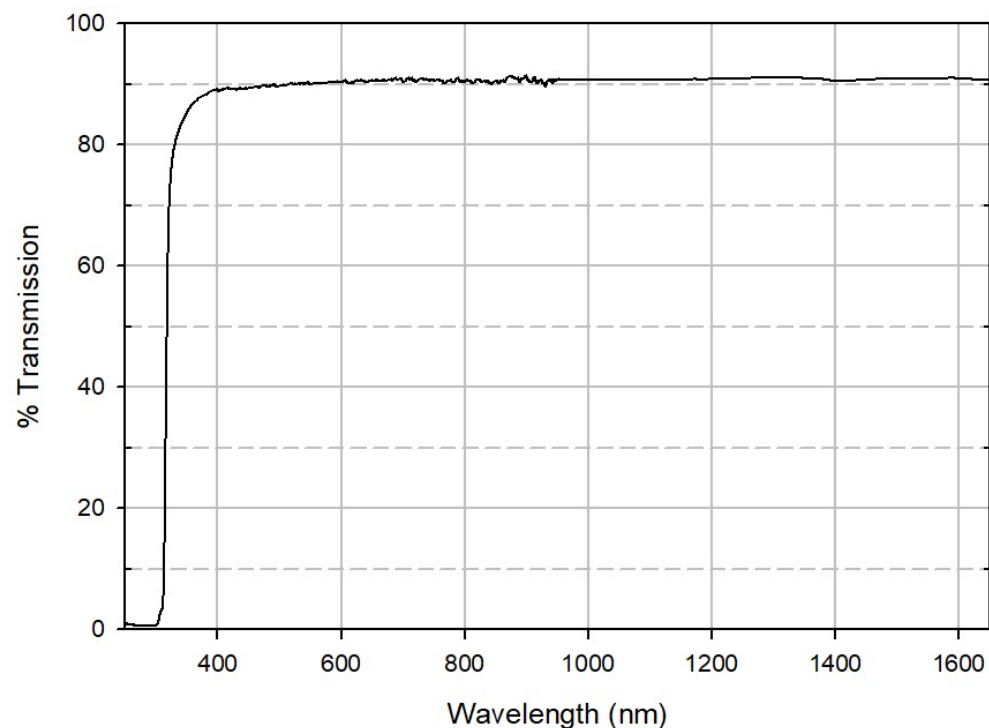




Optically Clear Films

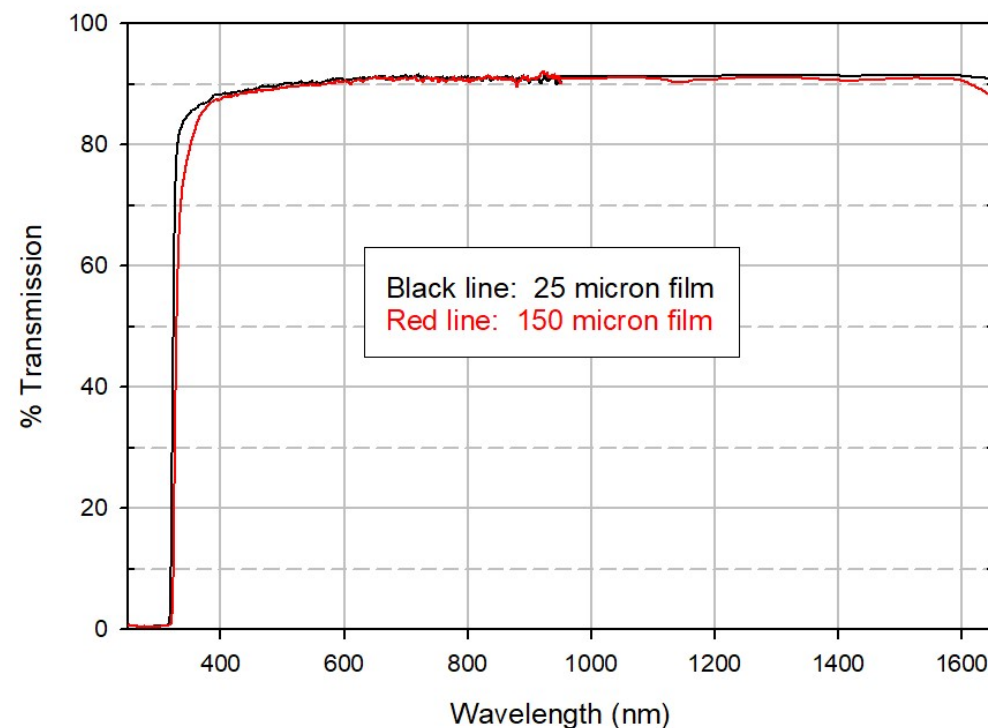
PR-1600-CA

PR1600-CA 75 micron film on Gorilla Glass
air reference, no correction for surface reflection



PR-1612

PR1612 Free-Standing Films
air reference, no correction for surface reflection



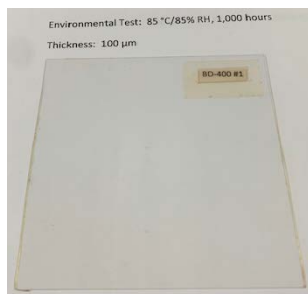
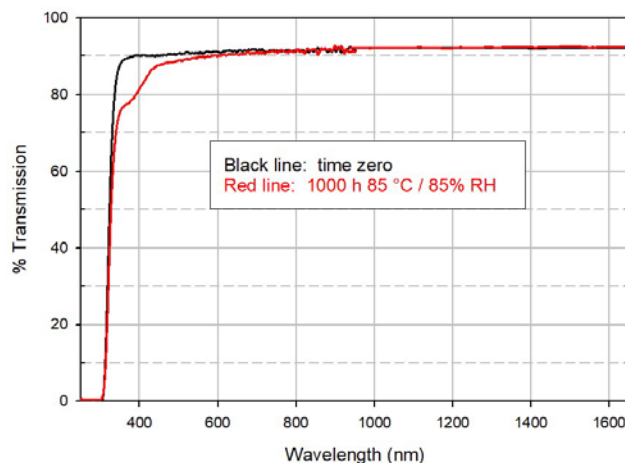


Environmental Stress Studies

Temperature – Humidity Chamber 85 °C, 85% Relative Humidity

BD-400 1000 hours

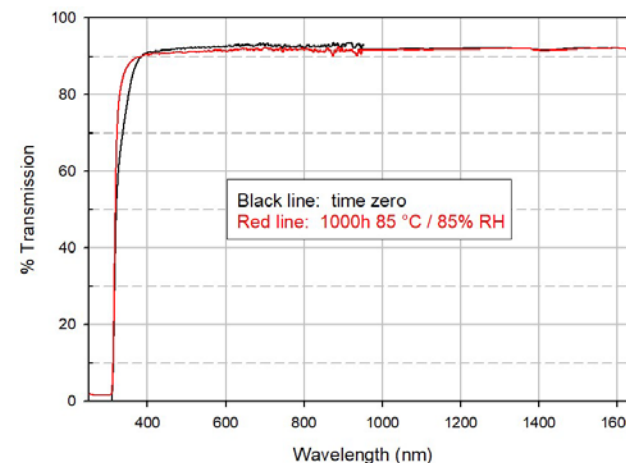
BD400 100 micron film on glass
air reference, no correction for surface reflection



1000 cycles

IP-158 1000 hours

IP158 on Gorilla Glass, 85/85 test
air reference, no correction for surface reflection



0 cycle



1000 cycles

Results after 1000 hrs of 85 °C, 85% Relative humidity: Optically clear - excellent, no delamination, no cracking, good candidates for electronics and automotive applications.

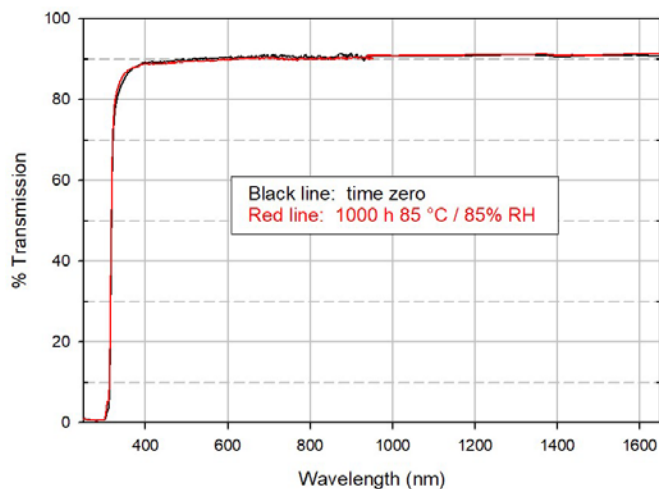


Environmental Stress Studies

Temperature – Humidity Chamber 85 °C, 85% Relative Humidity

PR-1600-CA 1000 hours

PR1600-CA on Gorilla Glass 85/85 EV test
air reference, no correction for surface reflection



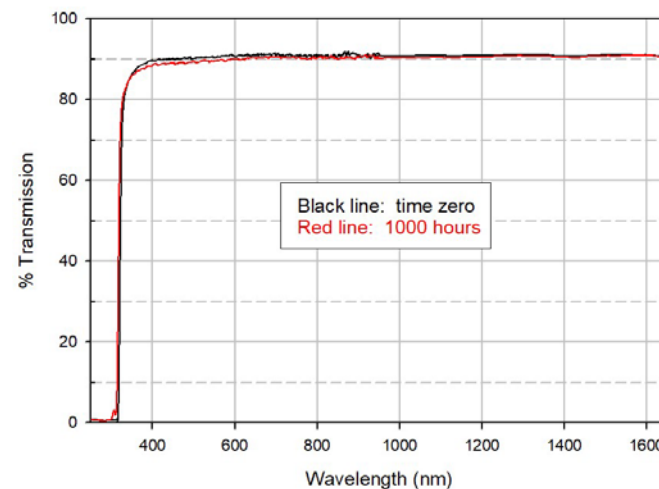
0 cycle



1000 cycles

PR-1612 1000 hours

PR1612 on Gorilla Glass, 85 °C / 85% RH
air reference, no correction for surface reflection



0 cycle



1000 cycles

Results after 1000 hrs of 85 °C, 85% Relative humidity: Optically clear - excellent, no delamination, no cracking, good candidates for electronics and automotive applications.

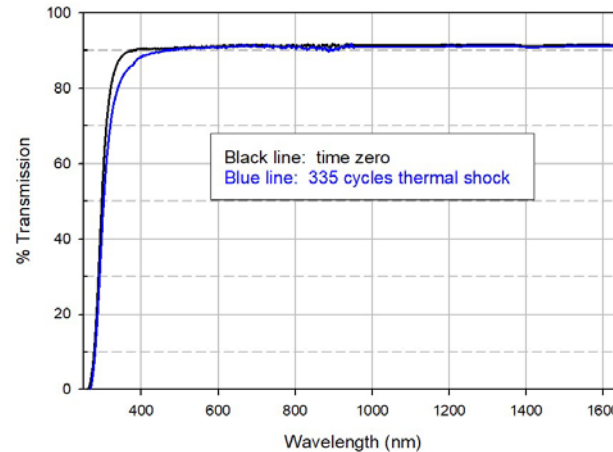


Thermal Shock Studies

Thermal Shock: 150 °C / -40 °C 30 minutes each per cycle

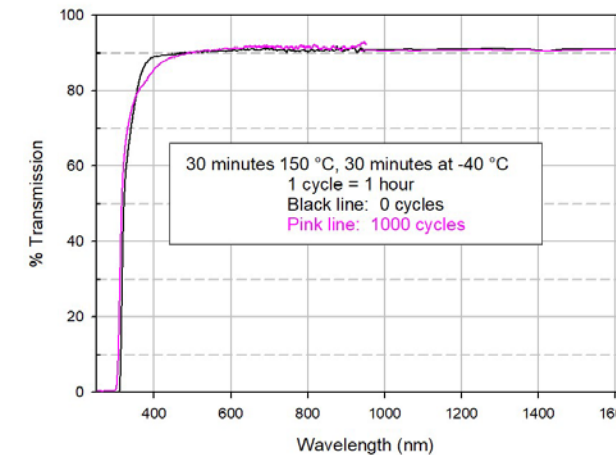
BD400 335 cycles

BD400 50 micron film on Gorilla Glass
air reference, no correction for surface reflection



IP158 1000 cycles

IP158 50 micron on Gorilla Glass Thermal Shock
air reference, no correction for surface reflection



0 cycle



1000 cycles

IP-158 shows excellent performances against thermal shock for 1000 cycles: Optically clear - good, no delamination, no cracking, good candidates for electronics and automotive applications. BD-400 is expected to have similar performances after 1000 hours of thermal shock. Data for BD-400 will be updated.

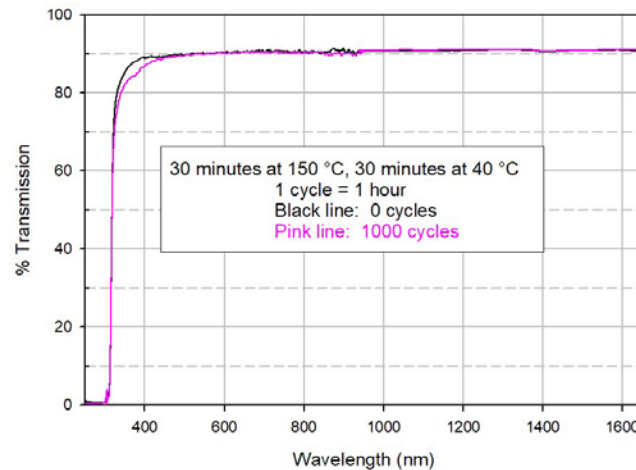


Thermal Shock Studies

Thermal Shock: 150 °C / -40 °C 30 minutes each per cycle

PR1600-CA 1000 cycles

PR1600-CA 50 micron on Gorilla Glass
air reference, no correction for surface reflection



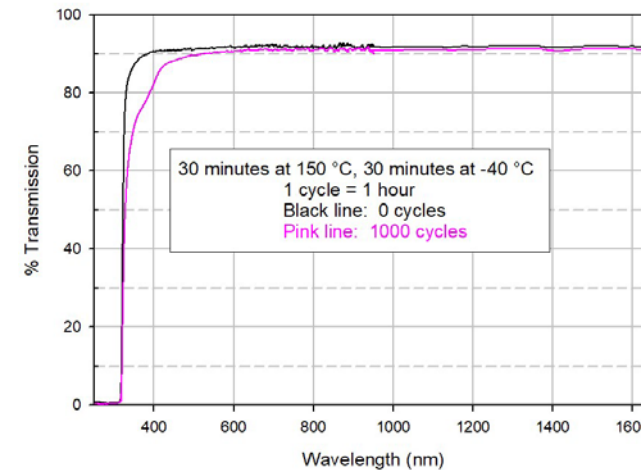
0 cycle



1000 cycles

PR1612 1000 cycles

PR1612 50 micron on Gorilla Glass
air reference, no correction for surface reflection



0 cycle



1000 cycles

PR-1600-CA shows excellent performances against thermal shock for 1000 cycles: Optically clear - good, no delamination, no cracking, good candidates for electronics and automotive applications.



Conclusions

- ACW P-NIL resins for Diffractive Optical Elements (DOE) applications have good adhesion to glass under both heat/humidity conditions and thermal shock conditions. ACW offers a wide range of refractive indices for ease of DOE design.
- ACW P-NIL resins offer excellent optical clarity against heat/humidity and thermal shock conditions.
- The excellent stress resistance ACW P-NIL DOE resins make them suitable for many types of electronic applications as well as lens for modules or sensors for automotive use.