Dec 2022

Technical Data Sheet

RAVolution™ LH
for vacuum casting applications

INTRODUCTION

RAVolution™ LH is a bi-component polyurethane resin specifically developed for vacuum casting operations.

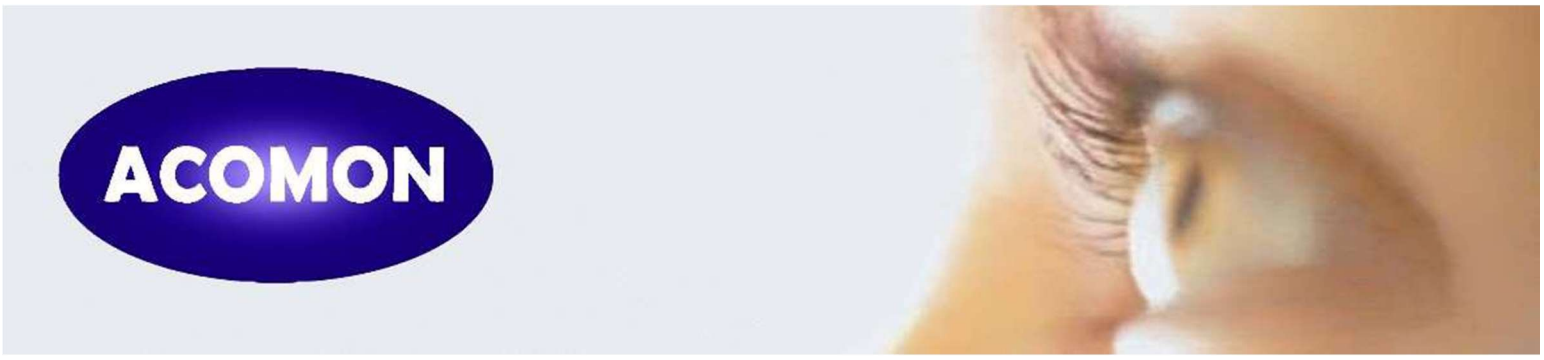
The main features of RAVolution™ LH are:

- High reactivity and good conversion using moderate polymerization conditions
- Mild towards silicone molds → long mold lifetime
- Excellent polymer optical properties: excellent color, high Abbe value, high clarity, low haziness
- Superior polymer ageing behavior, UV resistant
- Suitable for in mass colored and tinted parts
- Available in packages to cut all UV + part of the HEV* blue light for better personal protection
- Excellent coatability

POLYMER PROPERTIES OF RAVolution™ LH

Polymer specimens conditioned at 23°C, 50% of relative humidity.

Property	Method	Result
Yellow Index, num	ASTM D1925	<0.30
Total Transmittance, %	ASTM D1003	>92
Refractive index n_D^{20}, num	ASMT D542	1.513
Hardness - Shore D1, num	ASTM D2240	98
Density, g/cm3	ASTM D792	1.140
Shrinkage %, num	ASTM D792	5.1
Heat Deflection temperature (HDT),°C	ASMT D648	68
Impact resistance - IZOD, Kj/m^2	ASTM D256	57
Glass transition, °C	ISO 11357-2: 2014	87
ΔH_{pol} - residual, J/g	ISO 11357-2: 2014	<1.0
Young flexural modulus E, MPa	ASTM D4065: 2020	3300
Ultimate tensile strength UTS, MPa	ISO 527: 1993	85
Linear Shrinkage, mm/m	-	6



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RAVolution™ LH
Optical properties & Ageing behavior

RAVolution™ LH is a bi-component polyurethane resin specifically developed for vacuum casting operations.
Besides the excellent resin processability and good mechanical properties of the final polymer, RAVolution™ LH exhibits superior optical features such as:

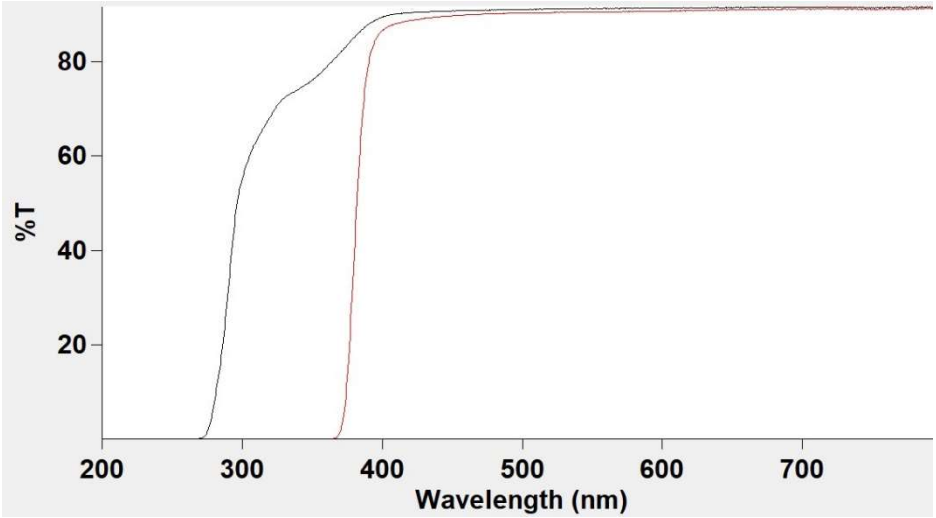
- excellent color, high Abbe value, high clarity, low haziness
- Superior polymer ageing behavior, UV resistant

Property	Method	Result
Yellow Index, num	ASTM D1925	<0.30
Total Transmittance, %	ASTM D1003	>92
Refractive index n_D^{20}, num	ASMT D542	1.513
Abbe number, num	ASTM D542	54

The optical properties of RAVolution™ LH are dependent on its unique composition which makes the polymer almost transparent to UVA and mostly UVB radiations, preventing from the extreme yellowing experienced by the typical polyurethane substrate used for vacuum casting applications.

UV Visible **spectra**. 3mm flat sheets*

***curing= 3hs @ 70°C in silicone molds – post curing= 70°C (1h) → 80°C (2hs) → 100°C (2hs)**



Black spectrum → RAVolution™ LH

Red spectrum → standard clear PUR resin

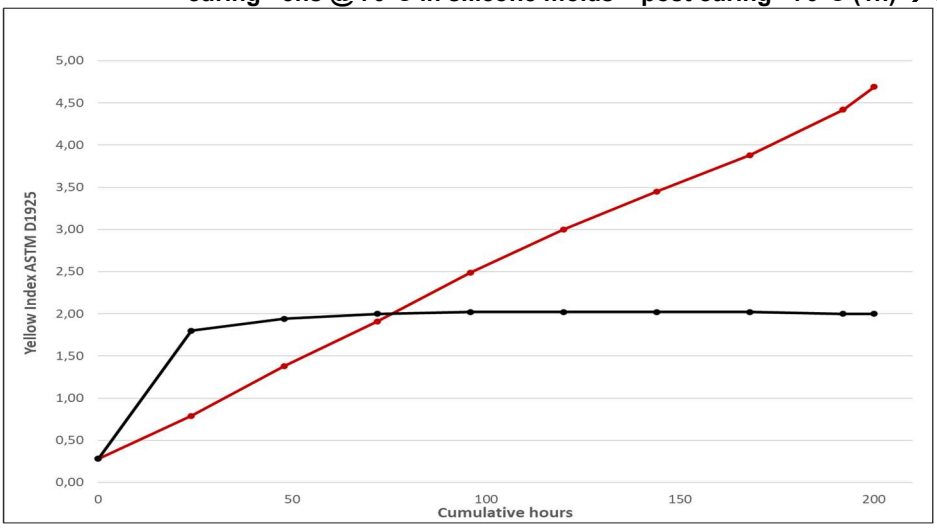
RAVolution™ LH shows a cut off transmittance at roughly 275nm (T%<1.0), while at 315nm where the UV-A radiations band starts, its total transmittance is well above 60%.
A standard PUR material for vacuum casting technology shows a cut off transmittance at roughly 370nm, thus not transparent to both UV-A & B radiations.

The evidence of the superior UV transparency is confirmed by the results of the ageing tests as per the rules ISO 12311-2:

a) Q-UV accelerated ageing test → resistance of the optical materials under UV radiations exposure
b) Weatherometer accelerated ageing test → resistance of the optical materials under Xenon lamp radiations exposure

a) Q-UV test[1]. 3mm flat sheets*

***curing= 3hs @ 70°C in silicone molds – post curing= 70°C (1h) → 80°C (2hs) → 100°C (2hs)**



Black line → RAVolution™ LH

Red line → standard clear PUR resin

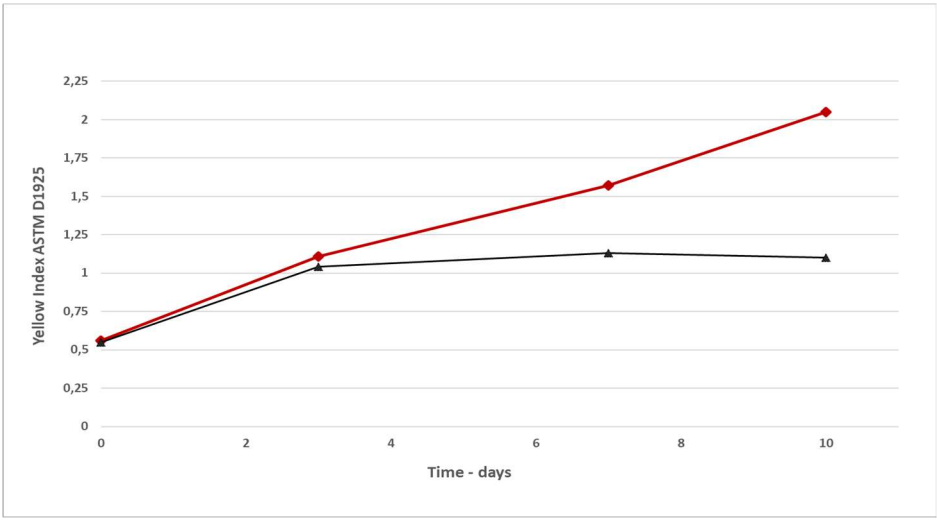
1= QUV tester model QUV/se with Solar Eye Irradiance Control – 0.5 W @ 50 °C for 200 hs

After a first 'natural-yellowing' which is typically shown by transparent materials under UV exposure, RAVolution™ LH reaches a stable plateau without yellowing further.
On the contrary, a standard clear PUR substrate, not transparent at UV radiations, continues to absorb energy without reaching a stable state and becomes yellow to a much higher extent than RAVolution™ LH.

A similar trend is also observed in the accelerated weathering test by means of Xenon lamp irradiation, the source resembling the visible light spectrum the most.

b) Weatherometer test[2]. 3mm flat sheets*

***curing= 3hs @ 70°C in silicone molds – post curing= 70°C (1h) → 80°C (2hs) → 100°C (2hs)**



Black line → RAVolution™ LH

Red line → standard clear PUR resin

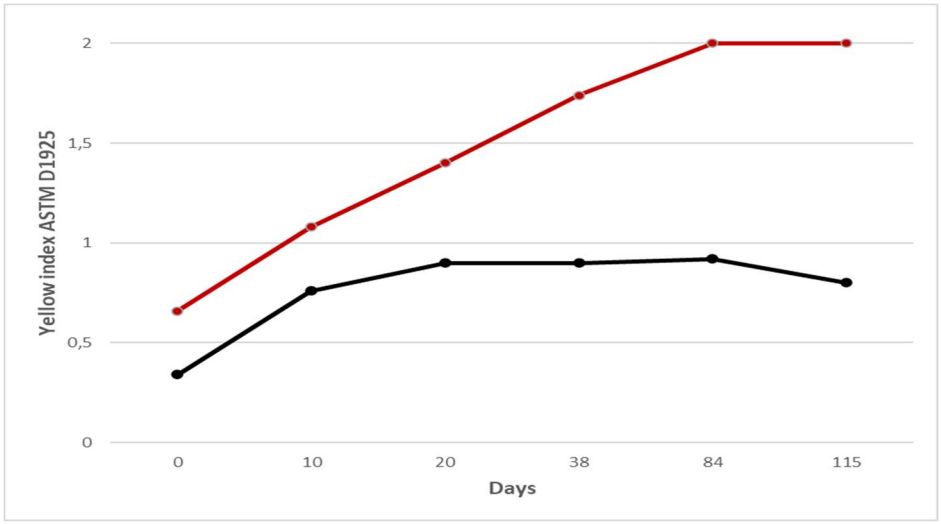
2= Xenon-meter model Q-SUN XE-1-B – 60W/m2 @ 50°C for 240 hs

The behavior under natural light exposure represents a distinguishing feature for polyurethane substrate used in vacuum casting for the possibility to be used not uniquely for prototypes, but also in manufacturing series for final consumers thanks to the absence of relevant yellowing.

For that reason, results of the xenon accelerated weathering test have been corroborated by a continuous prolonged exposure at natural light by performing a standard 'building roof test'.

Building roof test[3]. 3mm flat sheets*

***curing= 3hs @ 70°C in silicone molds – post curing= 70°C (1h) → 80°C (2hs) → 100°C (2hs)**



Black line → RAVolution™ LH

Red line → standard clear PUR resin

3= non- stop exposure under daily light on the building roof – duration= 4 months

While a standard clear polyurethane substrate confirms a significant yellowing, RAVolution™ LH exhibits an outstanding stability to natural light exposure which makes it the ideal material for preparation of special optical products by means of vacuum casting process.

REMARK:

All the reported tests have been performed on neat substrates without additives.
RAVolution LH is also available in packages to cut all UV + part of the HEV* blue light for better protection from dangerous radiations.