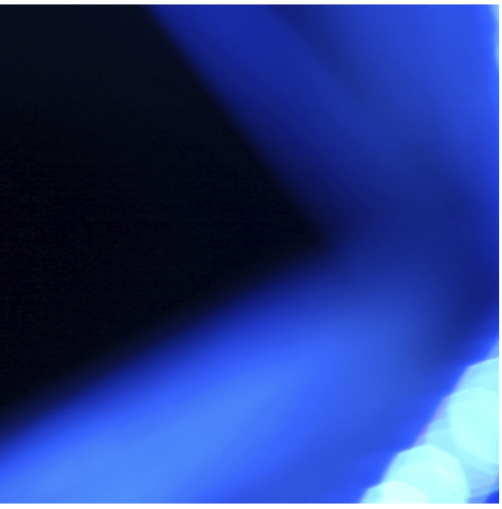
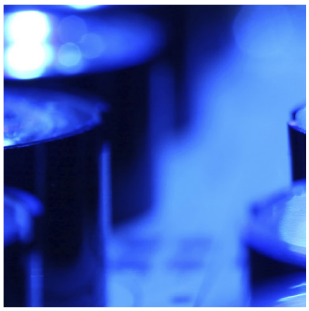
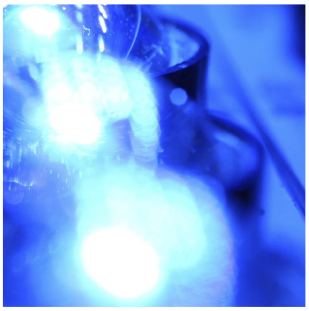






UV LED

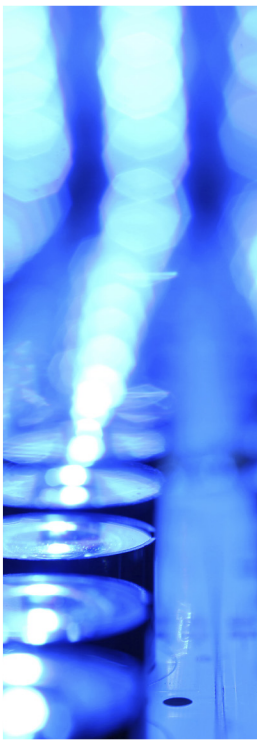
Product guide

We Enable the Transformation of Light for a Better Future.

IGM RESINS

UV LED

Product guide resin



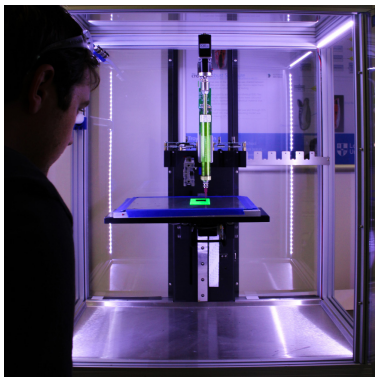
ENERGY CURING RAW MATERIAL AND TECHNICAL SOLUTION PROVIDER

IGM Resins is the leading global provider of energy curable raw material solutions to a wide variety of industries such as graphic arts, industrial coatings, adhesives and 3D printing. The combination of our global presence, unique market driven and customer focused approach, technical and regulatory support, and our comprehensive portfolio of products covering photoinitiators, monomers, oligomers and additives, is the cornerstone of our success.

Our dedication to energy curing technology and the markets we serve is emphasized by the development of next generation products for innovative integrated solutions, and ongoing investment into state-of-the-art manufacturing capabilities.

HOW TO GET MORE FROM US

UV LED technology offers several well-known advantages to energy curing in comparison with conventional UV lamps:



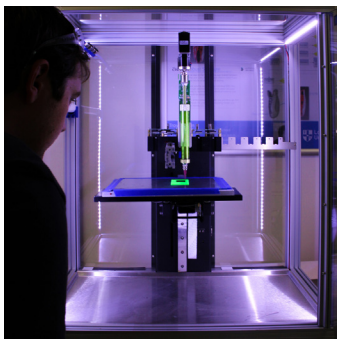
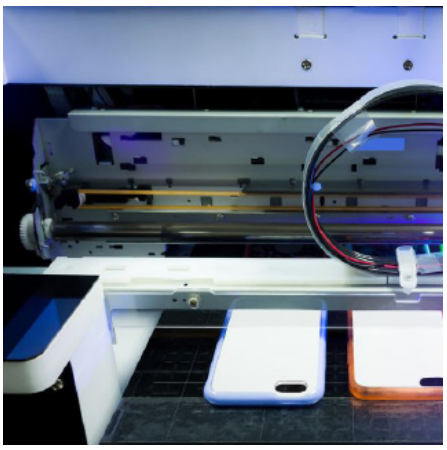
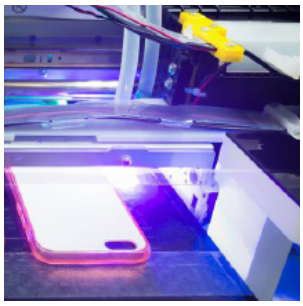
Technical Capabilities
- Suitable for heat sensitive, thin substrates
- Deep, through curing due to higher wavelength
- Small footprint
- Controlled curing intensity

Operating economics
- Energy efficient
- Long lifetime & low maintenance
- Low operating temperature
- Switch on/off

Environmental
- Mercury free
- Ozone free

To meet these challenging requirements, IGM Resins offers different solutions. In this leaflet you will find information about our product portfolio.

For more details, contact your local sales representative or send us an email to sales@igmresins.com for Europe and Asia and ussales@igmresins.com for America.

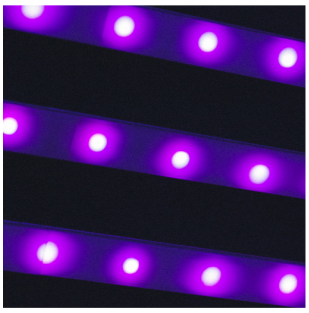

UV LED CHALLENGES

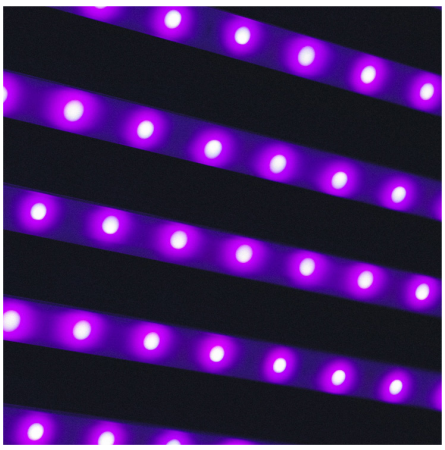
UV LED technology also presents some challenges: surface cure is difficult to achieve due to oxygen inhibition and single wavelength and cooling equipment is required.

To overcome the oxygen inhibition, physical and chemical methods are available:

Physical methods:
- High-intensity light
- High PI concentrations (some radicals react with oxygen)
- High-viscosity monomers / oligomers (slow oxygen diffusion)
- Nitrogen inerting (eliminates oxygen)
- Wax additive (barrier to oxygen diffusion into the coating)
- Laminate (prevents oxygen diffusion into the coating)

Chemicals methods:
- PI package for balanced cure optimisation
- Amine modified acrylates for type I or type II.
- Tertiary amine additives
- Phosphine and phosphite additives





PHOTOINITIATORS FOR 365 nm UV LED

Product	Chemistry	CAS Number	UV-Absorption nm	Melting point °C	Degree of yellowing	Sensitive application Nestle Compliant
Omnirad 819	Type I	162881-26-7	237, 275, 380	127–133	Low	Y
Omnirad TPO	Type I	75980-60-8	275, 379	91–94	Low	N
Omnirad TPO-L	Type I	84434-11-7	230, 275, 370	Liquid **	Low	Y
Omnipol TP	Polymeric Type I	Proprietary	360, 395	Liquid **	Medium	Y
Omnirad 379	Type I	119344-86-4	330	88–93	Medium	Y
Omnirad 369	Type I	119313-12-1	232,323	110-114	Medium	N
Omnirad 907	Type I	71868-10-5	230,303	73-76	Medium	N
Omnirad 403	Type I	145052-34-2	300,350	105-119	Medium	Y
Esacure KIP 160 + Omnirad 819	Type I	162881-26-7 + 71868-15-0	237, 275, 380	-	Medium	Y
Omnirad ITX	Type II	5495-84-1	255, 384	70–76	High	N
Omnirad DETX	Type II	82799-44-8	261, 385	71–74	High	N
Esacure 3644	Type II	2243703-91-3	325, 375	68-71	Medium	Y
Omnirad EMK	Type II	90-93-7	248, 374	93-96	High	N
Omnirad 2022	Type I	Blend	360	Liquid **	Low	N
Omnirad 2100	Type I	Blend	370	Liquid **	Low	Y
Omnirad BL 724	Type I	Blend	275, 354, 370	Liquid **	Medium	N
Omnirad BL 750	Type I	Blend	370, 380	Liquid **	Low	N
Omnipol 910	Polymeric Type I	886463-10-1	230, 325	Liquid **	Medium	Y
Omnipol TX	Polymeric	813452-37-8	245, 280, 390	Liquid **	High	Y
Omnipol BL 728	Polymeric Blend	proprietary	245, 280, 300, 390	Liquid **	High	Y

* Disclaimer:
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**: At room temperature
NESTLE Compliant (Aug 2018)

PHOTOINITIATORS FOR 395 nm UV LED

Product	Chemistry	CAS Number	UV-Absorption nm	Melting point °C	Degree of yellowing	Sensitive application Nestle Compliant
Omnirad 819	Type I	162881-26-7	237, 275, 380	127—133	Low	Y
Omnirad TPO	Type I	75980-60-8	275, 379	91—94	Low	N
Omnirad TPO-L	Type I	84434-11-7	230, 275, 370	Liquid **	Low	Y
Omnipol TP	Polymeric Type I	Proprietary	360, 395	Liquid **	Medium	Y
Omnirad 369	Type I	119313-12-1	232,323	110-114	Medium	N
Omnirad 907	Type I	71868-10-5	230,303	73-76	Medium	N
Omnirad 403	Type I	145052-34-2	300,350	105-119	Medium	Y
Omnirad ITX	Type II	5495-84-1	255, 384	70—76	High	N
Omnirad DETX	Type II	82799-44-8	261, 385	71—74	High	N
Esacure 3644	Type II	2243703-91-3	325, 375	68-71	Medium	Y
Omnirad EMK	Type II	90-93-7	248, 374	94-96	High	N
Omnirad 2022	Type I	Blend	360	Liquid **	Low	N
Omnirad 2100	Type I	Blend	370	Liquid **	Low	Y
Omnirad BL 750	Type I	Blend	370, 380	Liquid **	Low	N
Omnipol TX	Polymeric	813452-37-8	245, 280, 390	Liquid **	High	Y
Omnipol BL 728	Polymeric Blend	proprietary	245, 280, 300, 390	Liquid **	High	Y

**: At room temperature
NESTLE Compliant (Aug 2018)

AMINE SYNERGISTS

Product	Chemical identity	Viscosity mPa.s	Product attributes
Omnipol ASA	Poly(ethylene glycol) bis(p-dimethylaminobenzoate)	320 (40°C)	Polymeric Aminobenzoate; high MW
New Omnipol 894	N -methyl-N -phenyl-, 1,1',1''-triester with 2-ethyl-2-(hydroxymethyl)-1,3-propanediol	17.5 (25°C)	Aromatic amine synergist with hydrophobic characteristics

MONOMER ACRYLATES

Product	Chemical identity	Functionality	Viscosity mPa.s at 25°C	Product attributes
Photomer 4666	DPHA	5	5 500	High reactvity, hardness and scratch resistant
Photomer 4399	DPHA	6	13 000	High reactvity, hardness and scratch resistant
Photomer 4306	Di-TMPTA	4	550	High reactivity
Photomer 4149	TMP3(EO)TA	3	63	High reactivity, coating hardness, tensile strength
Photomer 4157	TMP9(EO)TA	3	105	Flexibility, impact resistance, abrasion resistance, water dispersible

POLYESTER / POLYETHER ACRYLATES

Product	Chemical identity	Functionality	Viscosity mPa.s at 25°C	Product attributes
Photomer 5442	Polyester acrylate	6	9 500	Fast cure, litho properties, very good pigment wetting, good flow ability
PureOmer 5443	Polyester acrylate	6	32 500	High reactivity, petta and petia free, good litho performance Bio-based Content (ASTM D6866-21) : 47 %
PureOmer 5450	Polyester acrylate	6	9 500	High reactivity, litho properties, pigment wetting Bio-based Content (ASTM D6866-21) : 40 %
PureOmer 5662	Amine modified polyether acrylate	4	3000	Adhesion, flexibility, coating hardness Bio-based Content (ASTM D6866-21) : 14 %
PureOmer 5850	Amine modified polyether acrylate	2.5	105	Low viscosity, high reactivity Bio-based Content (ASTM D6866-21) : 18 %
Photomer 5930	Amine modified polyether acrylate	4	500	Pigment wetting, high reactivity, chemical resistance, oxygen inhibitor

POLYURETHANE ACRYLATES

Product	Chemical identity	Functionality	Viscosity mPa.s at 25°C	Product attributes
Photomer 6577	Aromatic urethane 10 acrylate	10	190 000	High elongation, excellent flexibility, good abrasion resistance, adhesion
Photomer 6628	Aliphatic urethane hexaacrylate	6	80 000	Cure speed, impact resistance, scratch and chemical resistance, non-yellowing
Photomer 6631	Aliphatic urethane acrylate	6	30 000	Good scratch and abrasion resistance, high reactivity
Photomer 6648 ◊	Aliphatic urethane tetraacrylate	4	8000	Tin free, good mechanical and chemical resistance, good abrasion resistance in combination with high flexibility
Photomer 6692	Aliphatic urethane hexaacrylate, petia free + tin free	6	5 500	Excellent abrasion resistance, good hardness, good chemical and water resistant
Photomer 6720	Aromatic urethane acrylate	6	28 500	Fast cure, impact strength, hardness, abrasion resistance
Photomer Aqua 6903	Water dilutable urethane acrylate	6	30 000	Fast curing, excellent toughness

◊Tin Free

ACRYLATED AMINES FOR TYPE I AND TYPE II

Product	Chemical identity	Functionality	Viscosity mPa.s at 25°C	Product attributes
Photomer 4068	Acrylated amine synergist	2,5	125	Cure speed, high reactivity, chemical resistance, oxygen inhibitor, type I booster
Photomer 4250	Amine modified polyether acrylate	2,5	350	Cure speed, high reactvity, oxygen inhibitor, type I booster
Photomer 4771	Acrylated amine synergist	2	700	Cure speed, non-yellowing, low viscosity
Photomer 4775	Acrylated amine synergist	2	3200	Cure speed, non-yellowing, low viscosity
Photomer 4780	Acrylated amine synergist	2	1150	Cure speed, non-yellowing, low viscosity
Photomer 4967	Acrylated amine synergist Acrylated amine synergist	1	23	Cure speed, high reactvity, chemical resistance, oxygen inhibitor, type I booster
Photomer 5006	Amine modified polyether acrylate	1	73	Cure speed, high reactivity, chemical resistance, oxygen inhibitor

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BOOSTING REACTIVITY - THE SYNERGISTIC EFFECT OF AMINES ON TYPE I PHOTOINITIATORS

Our Photomer acrylated amine synergists and Omnipol polymeric amines were designed first and foremost as alternatives to the tertiary amines commonly used in combination with type II photoinitiators.

A new perspective on the synergistic effect of amines in combination with type I photoinitiators is proposed in this comparative study. The aim is to understand whether the combination with amines could lead to an increase in the rate of surface cure, due to reduced oxygen inhibition effects.

The correlation study of amines and type I photoinitiators on reactivity was carried out in a clear coating and in a standard ink.

Amines tested in this study:
- Amino acrylates,
- Amino benzoates,
- Aromatic amine synergists.

In combination with the following type photoinitiators:
- Phosphine oxide derivatives,
- Alpha amino ketones.

CLEAR COATINGS : THE EFFECT OF OUR AMINES

	Phosphine oxide derivative	Alpha aminoketones
Energy	**395 nm LED**	**395 nm LED**
Improvement when adding amine to Type I photoinitiator	Up to 3 times faster	Up to 2 times faster
Amino acrylate		
Amino benzoate		
Aromatic amine		
Without amine		

Adding amines to a type I photoinitiator increases through cure reactivity. The effect of the amine can be improved by varying the combination used.

CYAN FLEXO INKS : THE EFFECT OF OUR AMINES

Energy	**395 nm LED**	
Test	**Surface cure**	**Through cure**
Improvement when adding amine to Type I photoinitiator	Up to 2 times faster	Up to 2 times faster
Amino acrylate		
Amino benzoate		
Aromatic amine		
Without amine		

Originally tested for surface curing, amine synergists together with type I photoinitiators are also effective for deep curing.

CONSIDERATION OF THE AMINE CONTENT

The degree of reactivity is influenced by the nitrogen content of the co-initiators. All previous product comparisons were conducted using the same percentage. We can provide nitrogen content information to help you to optimise the synergy efficiency of the photoinitiator and amine in your formulation.

Our technical team is here to offer you support and advice to help you meet your goals. For our full product range, please refer to the UV/EB Radcure Product Guide or visit our website.

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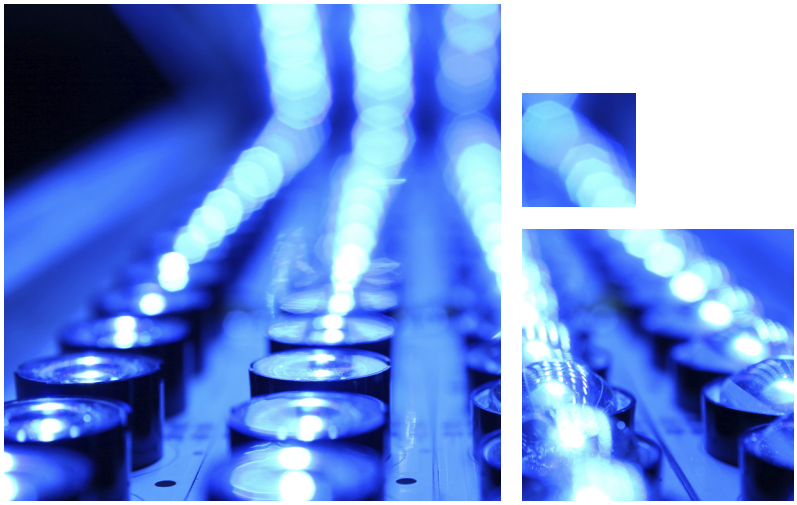

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