

# Energy curable resins for inks and coatings.





### Building a circular future, together

At Covestro, we use our unique skills in material solutions to make the world a brighter place. We create solutions that nourish, protect, and improve the performance of millions of products all over the globe. At the same time, our solutions contribute to a more circular world. This is reflected in our approach to the Energy Curable Industry.

#### Leading the way

The demand for more circular solutions is rising at a faster pace than ever before as the world collectively strives to tackle today's global challenges. Climate change, population growth, urbanization, digitalization and mobility are pushing players from every sector to find more sustainable solutions and lay the foundations for climate neutrality by driving a Circular Economy. The challenge is not only to create these circular solutions but also to maintain quality, durability and productivity.

#### Drive to push boundaries to what is possible

Innovation is key to satisfying these demands and creating added value for customers, society and the environment by turning targets into realities. At Covestro, our longstanding expertise in aliphatic and aromatic polyisocyanates and more sustainable resins goes hand in hand with our purpose to constantly push boundaries in the search for future-oriented solutions. Through joint solutions, alternative raw materials, innovative recycling, and harnessing renewable energy, we're enabling coatings and adhesives producers to meet the circular challenge, here and now.

#### Our portfolio

We're expanding our portfolio to include bio-based or recycled raw materials in coatings, adhesives, and specialty areas from cosmetics to textiles to 3D printing. Thanks to our mass balancing approach, we're helping close the loop by gradually replacing fossil fuels with ISCC-certified renewable resources. Our drop-in solutions ensure the high quality, consistent performance and easy processing

that keep your production running smoothly. And we're constantly working to provide the global support, facilities and supply chain security you need to forge yet more circular innovations in infrastructure, automotive, furniture and more.

#### **Energy curable resins**

Our broad portfolio of Energy Curable Resins consists of monomers, epoxy and polyester acrylates, acrylated and solid acrylics and amine acrylates. All products are sold under the AgiSyn<sup>™</sup>, NeoRad<sup>™</sup> product ranges. The energy curable technology is used in many industrial applications. Nevertheless, it is a technology which still has many opportunities for innovation, not only to improve the performance in existing application areas, but also to take it to new markets.

Material solutions can help turn circular targets into realities. Let's make the world a brighter place, together.



#### Aliphatic urethane acrylates

Of all the acrylates resins, urethane acrylates possess best balance between hardness, toughness, flexibility, chemical resistance and abrasion resistance. Due to their resistance to weathering and low yellowing, aliphatic urethane acrylates are preferred over aromatic urethane acrylates in high-end applications.

		UNCTION ORETICA	NALITY AL VALUE	VISCOSIT PA.S AT 25		YDROXYL V ig KOH per		Tg ℃		ADHESION	I	FLEXIBILITY	′ I	REACTIVITY
			MOLECULAR W THEORETICAL		ACID VALU mg KOH per (		COLOR GARDNER		FEATURES		CHEMICAL RESISTANCE		HARDNESS	
AgiSyn™ 230A2	Aliphatic urethane acrylate	6	1,000	65–85	<2	38	<2	35	Good scratch resistance offering excellent adhesion to various industrial plastics.	•••	••••	•	••••	•••
AgiSyn™ 230A3	Aliphatic urethane acrylate	6	1,000	90–120	<2	35	<2	35	Good scratch resistance with excellent adhesion to various industrial plastics.	•••	••••	•	••••	•••
AgiSyn™ 230T1	Aliphatic urethane acrylate	2	1,500	55–75	<2	<10	<2	-25	Good flexibility, wear resistance and toughness.	••	•	•••	•	••
AgiSyn™ 242	Aliphatic urethane acrylate	8	1,000	30–50	<2		<2		Very high scratch resistance providing excellent adhesion to various industrial plastics.	•••	••••	•	••••	••••
AgiSyn™ 2421	Aliphatic urethane acrylate	8	1,300	37–83	<1	<10	<1		Excellent steelwool resistance and excellent adhesion to various industrial plastics.	•••	••••	••	••••	••••
AgiSyn™ 530	Aliphatic urethane acrylate diluted with 25% butyl acetate	6	1,000	2–4	<2	27	<2		Easy-To-Matt resin offering easy gloss reduction for solvent based spray coatings.	•••	•••	•	•••	•••
NeoRad™ U-10-15H	Aliphatic urethane acrylate diluted with 15% HDDA	3	2,000	37.5–50.0	<1	<10	<2	14	General purpose resin exhibiting good alkaline resistance.	••	••	•••	••	••
NeoRad™ U-10-15T	Aliphatic urethane acrylate diluted with 15% TPGDA	3	2,000	115–150	<1	<10	<2	12	General purpose resin exhibiting good alkaline resistance.	••	••	•••	•	••
NeoRad™ U-20-12H	Aliphatic urethane acrylate diluted with 12% HDDA	2	1,200	1.9–2.3 (60°C)	<1	<10	<1	20	Excellent outdoor resistance and low yellowing.	••	••	•••	•	••
NeoRad™ U-23-20T	Aliphatic urethane acrylate diluted with 20% TPGDA	2	1,300	70–150	<1	<10	<2		Excellent abrasion resistance and low yellowing.	••	••	••	••	••
NeoRad™ U-24-25Z	Aliphatic urethane acrylate diluted with 25% HEMA	2	1,300	6–14	<1	110	<1		Very high toughness, excellent elongation and low shrinkage.	•••	••	•••	•	••
NeoRad™ U-25-20D	Aliphatic urethane acrylate diluted with 20% DPGDA	2	1,300	20–30	<1	<10	<1	18	High reactivity, excellent flexibility, good scratch and abrasion resistance.	••	••	•••	•	•••
NeoRad™ U-6282	Aliphatic urethane acrylate	2	1,200	0.25-0.45	<2	<10	<2	19	Low yellowing Easy-To-Matt resin offering easy gloss reduction.	••	••	•••	•	••
NeoRad™ U-80	Aliphatic urethane acrylate	2	4,500	27–37	<2	<10	<2		Excellent adhesion to melamine paper and very high elasticity.	•••	•	••••	•	•

## Aromatic urethane acrylates

FUNC THEORE				VISCOSITY PA.S AT 25°C				Tg °C	
	DESCRIPTION		DLECULAR W IEORETICAL		ACID VALU g KOH per g		COLOR GARDNER		FEATURES
AgiSyn™ 248	Urethane acrylate	3	900	0.05-0.10	<3	40	<6	19	An innovative, Silky feel, resin to obtain matt overprint varnishes (OPV) for flexo and screen applications.
AgiSyn™ 670A2	Aromatic urethane acrylate	6	950	24.5-32.5	<2	40	<2	49	Good scratch resistance, excellent adhesion to various industrial plastics.
AgiSyn™ 670T1	Aromatic urethane acrylate	2	1,600	270–330	<2	<10	<2	-24	Excellent wear resistance and toughness.
AgiSyn™ 670T1-D75	Aromatic urethane acrylate diluted with 25% DPGDA	2	1,600	5.5-7.5	<2	<10	<2	-26	Low viscosity, excellent wear resistance and toughness.
NeoRad™ U-60	Aromatic urethane acrylate	2	1,600	4.0-5.4 (60°C)	<1	<10	<2	-20	Excellent wear resistance and toughness.
NeoRad™ U-61	Aromatic urethane acrylate	2	1,200	1.2–1.6	<1	160	<2	25	Very high toughness, excellent elongation and low shrinkage. Good adhesion to various woods.

#### Polyester acrylates

By highly favorable cost-performance ratio and very wide selection of backbone building blocks, polyester acrylates are well suited for a high number of applications. They are available in a range of viscosities and cure speeds. Generally polyester acrylates exhibit moderate to high shrinkage but still provide a well-balanced elasticity.

		JNCTION DRETICA	JALITY AL VALUE	VISCOSI PA.S AT 2		′DROXYL V g KOH per (		Tg ℃	ADHESION FLEXIBILITY	REACTIVITY
	DESCRIPTION		MOLECULAR WI THEORETICAL V	-	ACID VALU mg KOH per g		COLOR GARDNER		FEATURES CHEMICAL RESISTANCE HAR	DNESS
AgiSyn™ 705	Fatty acid modified polyester acrylate	4	1,300	100-22	0 <20		<20	-3	Excellent pigment grinding vehicle. Based on 35% renewable materials.	•• ••
AgiSyn™ 707	Polyester acrylate	4	470	200–30	0 <1		<2		Recommended for offset inks, high viscosity, low tack, low misting and good flow.	•• ••
AgiSyn™ 716	Fatty acid modified polyester acrylate	6	1,100	7–10	<20	30	<13		Low odour, low extractable and low viscous grinding.	•••
AgiSyn™ 720	Polyester acrylate	4	1,000	0.4–1.0	) <20		<2	31	Very low viscosity, good silica wetting.	• ••
AgiSyn™ 730	Polyester acrylate	3	750	15–20	<5		<4	64	General purpose resin providing good stain resistance and silica wetting.	••
AgiSyn™ 740	Polyester acrylate	4	1,350	25–35	<8		<5		General purpose resin providing good silica wetting.	•• ••
NeoRad™ P-11	Polyester acrylate	3	750	25–45 (23°C)	<20	40	<4	7	Excellent silica wetting and good wear resistance.	• •••
NeoRad™ P-50	Polyester acrylate	4	1,100	1.5–2.1 (23°C)	<10	55	<2		Low odour, low extractable and low viscous flexo pigment grinding vehicle with good adhesion to various flexible plastic substrates. Based on 20% renewable materials.	•• ••••

ADHESION	F	FLEXIBILITY		REACTIVITY
	CHEMICAL RESISTANCE		HARDNESS	
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#### Epoxy acrylates

Epoxy acrylates are widely used in radiation curable formulations due to their cost-performance ratio combined with high reactivity. Cured coatings comprising on epoxy acrylates generally exhibit high gloss, high hardness and very high chemical resistance. The fatty acid modified epoxy acrylates provide some improved wetting and flexibility.

		UNCTIONALI		VISCOSITY PA.S AT 25°C		DROXYL VA g KOH per g		Tg °C	
	DESCRIPTION		LECULAR WE CORETICAL V		ACID VALU Ig KOH per g		COLOR GARDNER		FEATURES
AgiSyn™ 1010*	Bisphenol A epoxy acrylate	2	500	4–7 (60°C)	<2	220	<1	60	Multi purpose resin offering good mechanical properties.
AgiSyn™ 1030*	Bisphenol A epoxy acrylate	2	500	11–21 (50°C)	<2	220	<1	60	Multi purpose resin offering good wear resistance.
AgiSyn™ 1050*	Bisphenol A epoxy acrylate	2	500	2.0–4.5 (65°C)	<1	220	<3	60	Multi purpose resin with silica wetting.

#### Modified epoxy acrylates

		NCTIONALI DRETICAL V		VISCOSITY PA.S AT 25°0		/DROXYL VA g KOH per g		Tg °C	
	DESCRIPTION		LECULAR W CORETICAL	-	ACID VALU ng KOH per g		COLOR GARDNER		FEATURES
AgiSyn™ 2020	Epoxidised soya oil acrylate	3	1,100	23–33	<5	130	<7	35	General purpose resin with excellent wetting properties. Contains about 75% renewable materials.
AgiSyn™ 3020-A80	Modified epoxy acrylate diluted with 20% TPGDA	2	1,200	32–48	<5	70	<2	51	Tough epoxy acrylate exhibiting excellent metallization acceptation.
AgiSyn™ 3050	Modified epoxy acrylate	2	1,000	3.0–7.5 (60°C)	<5		<4	57	Tough epoxy acrylate offering excellent pigment wetting.
AgiSyn™ 3055	Fatty acid modified bisphenol A epoxy acrylate	2	550	34–40	<3	180	<3		Excellent pigment grinding.
AgiSyn™ 6050TF	Amine modified epoxy acrylate	2	500	68–85	<1		<1		Very fast curing epoxy acrylate to be used for Toluene Free applications.
NeoRad™ E-20	Fatty acid modified epoxy acrylate	2	550	2–4 (60°C)	<3	200	<3	43	Multi purpose resin offering good pigment wetting.

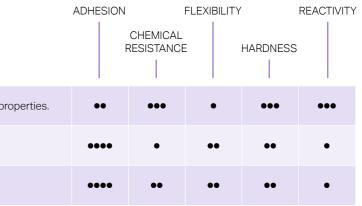
ADHESION	F	ELEXIBILITY	REACTIVITY	
	CHEMICAL RESISTANCE		HARDNESS	
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ADHESION	F	ELEXIBILITY	l	REACTIVITY		
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## Acrylics

Acrylics provide reduced shrink to a coating and achieve improved adhesion. Additionally depending on chemistry and use acrylics provide hardness and flexibility to an energy curable coating system. Inert acrylics are available as a solid material (also known as beads) and as a liquid in diluting acrylates.

		JNCTIONAL DRETICAL \		VISCOSITY PA.S AT 25°		YDROXYL VA 1g KOH per g		Tg °C	
	DESCRIPTION	-	LECULAR WI EORETICAL V	-	ACID VALU mg KOH per (		COLOR GARDNER		FEATURES
NeoRad™ A-20	Acrylated acrylic diluted with 50% with butyl acetate	20	30,000	0.5–1.0 (23°C)	<15	150	<4	42	Suitable for for dual cure. Good outdoor durable and excellent anti-sagging pro
NeoCryl® B-300	Solid methacrylic copolymer	Inert	15,000	0.7–1.3*	<1	<1	White powder	45	Low viscosity when dissolved in diluting acrylates, good scratch resistance.
NeoCryl® B-302	Solid methacrylic copolymer	Inert	5,000	0.4–0.8*	4	<1	White powder	80	Low viscosity when dissolved in diluting acrylates, high Tg.





• Low •• Moderate ••• Good •••• Excellent

#### Amine modified acrylates

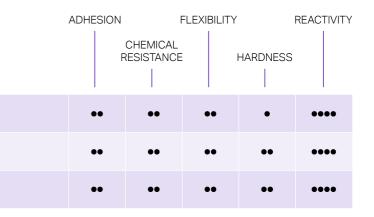
The typical combination of high cure speeds and overall balanced properties makes the amine modified acrylates unique. Often these resins are used to increase the cure speed without compromising on other coating characteristics.

		NCTIONALI RETICAL V		VISCOSITY PA.S AT 25°C		AMINE VALUE mg KOH per gram			
	DESCRIPTION	-	LECULAR W CORETICAL \	-	ACID VALUE mg KOH per gram		COLOR GARDNER		FEATURES
AgiSyn™ 701	Amine modified polyether acrylate	4	1,000	2.5–3.5	<1	55–65	<2	50	Excellent reactivity, good wetting.
AgiSyn™ 703	Amine modified polyether acrylate	4	1,000	0.45-0.65	<1	35–45	<2	6	Low viscosity and high scratch resistance.
AgiSyn™ 703TF	Amine modified polyether acrylate	4	1,000	0.45-0.65	<1	35–45	<1	6	Toluene free version of <b>AgiSyn™ 703.</b>

#### Amine synergists

Amine synergists are co-initiators which enhance the reactivity of UV curable systems. Best performance is achieved when combined with Norrish type II initiators. The acrylate functionality ensures this type of synergist is being incorporated in the final coating structure.

		NCTIONALI DRETICAL V		VISCOSITY PA.S AT 25°C		AMINE VALU 19 KOH per gi		Tg °C	
	DESCRIPTION	-	LECULAR WI ORETICAL V	-	ACID VALU ng KOH per g		COLOR GARDNER		FEATURES
AgiSyn™ 002	Functionalised amine synergist	1	400	0.01–0.03	<1	190–210	<2	11	Multi purpose synergist offering very high reactivity.
AgiSyn™ 003	Functionalised amine synergist	1	500	3.0-4.5	<1	250–270	<6	17	Highest amine content and excellent reactivity booster.
AgiSyn™ 008	Functionalised amine synergist	2	800	0.5–1.5	<1	120–150	<2	13	High reactivity and good adhesion.
AgiSyn™ 008TF	Functionalised amine synergist	2	800	0.5–1.5	<1	120–150	<2	13	Toluene free version of <b>AgiSyn™ 008.</b>



ADHESION	I	FLEXI	BILITY		REACTIVITY
	CHEMICAL RESISTANCE	-		HARDNESS	
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# Mono-functional diluting acrylates

	DESCRIPTION		ECULAR WEI DRETICAL VA		ACID VALUE 1 KOH per gra	COLOR APHA	STABILIZER ppm MeHQ	REFRACTIVE INDEX	Tg°C │	FEATURES	TOLUENE FREE	HIGH PURITY
AgiSyn™ 2822	Ethoxylated (2) 2-Phenoxy ethyl acrylate	56641-05-5	236	12–22	<0.5	<60	400-800	1.505	-45	- Strong dilution effect - Low shrinkage - Excellent adhesion (various plastics and metals) - High refractive index	1)	
AgiSyn™ 2832	2-Phenoxy ethyl acrylate	48145-04-6	192	5–15	<0.5	<60	200-600	1.515	7	<ul> <li>Strong dilution effect</li> <li>Low shrinkage</li> <li>Excellent adhesion (various plastics and metals)</li> <li>High refractive index</li> </ul>	1)	
AgiSyn™ 2870	Isobornyl acrylate	5888-33-5	208	5–15	<0.1	<30	90-275	1.474	80	<ul> <li>High Tg though good flexibility</li> <li>Excellent adhesion to a variaty of substrates</li> <li>Good outdoor resistance</li> </ul>		
AgiSyn™ 2880	2-(2-ethoxyethoxy)ethyl acrylate	7328-17-8	188	3–8	<0.5	<60	200-600	1.435	-53	- High flexibility - Good adhesion - Strong dilution effect	1)	
AgiSyn™ 2895	Ethoxylated (4) nonylphenol acrylate	50974-47-5	450	103–117	<0.1	<150	800-1300	1.493	-28	<ul> <li>Excellent adhesion properties</li> <li>Excellent dilution effect</li> <li>High cure response</li> </ul>	1)	
AgiSyn™ 2896	Lauryl acrylate	2156-97-0	240	4–10	<0.5	<30	100-200	1.444	-28	- Low surface tension - Good adhesion	1)	

# Di-functional diluting acrylates

	DESCRIPTION		ECULAR WEI ORETICAL VA		ACID VALUE g KOH per gram	COLOR APHA	STABILIZER ppm MeHQ	REFRACTIVE INDEX	Tg°C	FEATURES	TOLUENE FREE	HIGH PURITY
AgiSyn™ 2815	Tripropyleneglycol diacrylate	42978-66-5	300	10–18	<0.1	<100	200–1,000	1.450	64	-Multi purpose acrylate -Good dilution effect		
AgiSyn™ 2816	1.6-Hexanediol diacrylate	13048-33-4	226	5–10	<0.1	<60	100–300	1.457	41	-Multi purpose acrylate -Excellent adhesion to plastics -Strong dilution effect -Good outdoor resistance		
AgiSyn™ 2823	Ethoxylated (30) bisphenol A diacrylate $ \int_{a}^{b} \left( \int_{a}^{b} \int_{a}^{b} \int_{b}^{c} \int_{b}^{c}$	64401-02-1	1,672	700–1,000	<0.2	<200	100–300			-Good flexibility resistance -Good heat resistance -Good pigment wetting		
AgiSyn™ 2833	Dipropyleneglycol diacrylate	57472-68-1	242	7–13	<0.5	<40	400-800	1.449	96	-Multi purpose acrylate -Good dilution effect -High Tg		
AgiSyn™ 2863	Polypropyleneglycol (700) diacrylate $-\int_{n-13}^{n} -\int_{n-13}^{n-13} -\int_$	52496-08-9	808	70–90	<0.5	<150	50–100		-32	-Good wetting -Water miscible	1)	
AgiSyn™ 2866	Propoxylated (12) Ethoxylated (6) bisphenol A diacrylate f(a + b) = f(a +		<1,000	<0.8	<0.5	<150	80–120		-43	-Excellent hydrophilic/hydrophobic balance -Low shrinkage -Good flexibility -Good hardness		
AgiSyn™ 2873	Ethoxylated (10) bisphenol A diacrylate $ \begin{array}{c} \downarrow \\ \downarrow \\ \downarrow \\ a \\ \downarrow \\ a \\ +b=10 \end{array} \qquad $	64401-02-1	780	600-800	<0.2	<100	100–300			-Good chemical resistance -Good heat resistance -Good pigment wetting		
AgiSyn™ 2881	Ethoxylated (4) bisphenol A diacrylate $\downarrow \downarrow $	64401-02-1	512	1,000–1,300	<0.5	<100	200-800	1.538	63	-Good chemical resistance -Good heat resistance -Good pigment wetting		

# Multi-functional diluting acrylates

			ECULAR WE DRETICAL V4		ACID VALUE g KOH per gra	m	COLOR APHA	STABILIZER ppm MeHQ		Tg℃	FEATURES	TOLUENE FREE	HIGH PURITY
AgiSyn™ 2811	Trimethylolpropane triacrylate $\int \int \int$	15625-89-5	296	70–120	<0.1		<60	100–300	1.474	64	- Multi purpose acrylate - High reactivity		
AgiSyn™ 2830L	Dipentaerythritol hexaacrylate $\downarrow \downarrow $	29570-58-9	578	4,000–7,000	<0.5		<100	300–900	1.496	94	<ul> <li>Very high reactivity</li> <li>High crosslink density</li> <li>Excellent scratch resistance</li> <li>Excellent chemical resistance</li> </ul>		2)
AgiSyn™ 2836	Ethoxylated (3) trimethylolpropane triacrylate	28961-43-5	428	40–80	<0.2		<60	250–500	1.471	37	- Multi purpose acrylate - Good reactivity - Good chemical resistance		2)
AgiSyn™ 2837	Propoxylated (3) glyceryl triacrylate	52408-84-1	428	70–100	<0.5		<100	200–500	1.461	33	- Multi purpose acrylate - Excellent wetting - Good reactivity		2)
AgiSyn™ 2844	Ethoxylated (5) pentaerythritol tertraacrylate $\int \int $	51728-26-8	550	100–200	<1.0		<60	200–600	1.475	-33	- High reactivity - Good scratch resistance - Good solvent resistance		
AgiSyn™ 2851S	Tris (2-hydroxy ethyl) isocyanurate triacrylate $\downarrow \downarrow $	40220-08-4	423	Wax	<1.0		<100	300-1,200	1.465	247	<ul> <li>Extreme high Tg acrylate</li> <li>Excellent abrasion resistance</li> <li>Very good heat resistance</li> <li>High reactivity</li> </ul>		

# Multi-functional diluting acrylates

	DESCRIPTION		VISC PA.S ECULAR WEIGHT DRETICAL VALUE	COSITY AT 25°C ACID VALU mg KOH per 9	COLOR APHA	STABILIZER ppm MeHQ	REFRACTIVE INDEX	Tg°C │	FEATURES	TOLUENE FREE	HIGH PURITY
AgiSyn™ 2884	Pentaerythritol triacrylate	222-540-8	296 650	-1,200 <1.0	<100	300–990	1.484	100	<ul> <li>Hydroxyl functional acrylate (typical OH value = 125mg KOH/g)</li> <li>High reactivity</li> <li>Good adhesion</li> </ul>		
AgiSyn™ 2887TF	Di-trimethylolpropane tetraacrylate $\begin{array}{c} \downarrow\\ $	94108-97-1	466 40	0–700 <0.5	<100	400–600	1.475	98	- Fast cure response - Excellent chemical resistance - Good hardness	1)	
AgiSyn™ 2887HV-TF	Di-trimethylolpropane tetraacrylate $\downarrow$	94108-97-1	482 75	0–850 <0.5	<50	200–600	1.475	96	- High viscous grade of <b>AgiSyn™ 2887TF</b>	1)	



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