We create chemistry

BASF Acrylates and Methacrylates

UREIDO METHACRYLATE (UMA)

Product Information Brochure

Product Information

Through the addition of Ureido Methacrylate (UMA) in the polymer backbone, products with significant performance benefits can be produced. The use of UMA impact following properties

- Excellent adhesion (dry and wet)
- Better cohesion
- Good rheology modification

UMA is a monomer that can be used e.g. in emulsion polymerizations for interior and exterior paints, coatings and adhesives (e.g. PSA).

UMA Technology

- Copolymers of UMA can be prepared with acrylates, methacrylates, acrylic acid, methacrylic acid, acrylamides, acrylonitrile, vinyl acetate, vinylpyrrolidone, styrene etc. Typical usage levels are between 0.5 and 2.0 BOTM (active matter).
- The usage of UMA is recommended for waterborne acrylic and styrene acrylic binder systems
- UMA can be also used in polymerizations and co-polymerizations in bulk, emulsions and solution

UMA Products

UMA 25% MMA

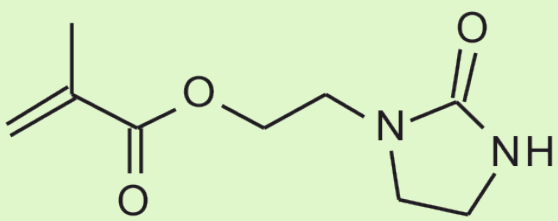
- 25% Active in MMA

UMA 50% H_2O

- 50% Active in Water
- Benefit: Low VOC

- Methacrylate polymerizable group
- Ureido ring functionality for enhancing cohesion and wet adhesion

Ureido Methacrylate (UMA)



Specification & Physicochemical Properties

Specification[1]	Unit	UMA 25% MMA	UMA 50% W
Assay (GC)	%	25 ± 2	50 ± 2.5
Water content (ASTM E 203)	%	≤ 0.040	50 ± 2.5
Standard Stabilization (ASTM D 3125)	ppm	75 ± 25 PTZ 500 ± 100 MEHQ	900 ± 100[a]
Color on dispatch (ASTM D 1209)	APHA	≤ 200	≤ 500

[a]: Total stabilizer content

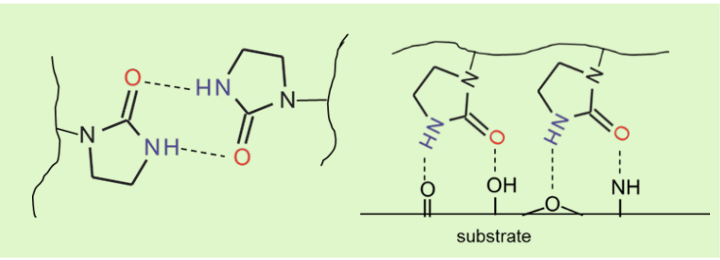
Monomer related data	Unit	UMA 25% MMA	UMA 50% W
Appearance		clear, yellowish	clear, yellowish
Physical Form		liquid	liquid
Odor		ester like	ester like
Density a 20 °C	g/cm^3	1.015	1.098
Flash point	°C	9	no flash point according to DIN 51758
Vapor pressure at 20 °C	mbar	37.0	23.4

Polymerization related data (pure UMA)	Unit	Value
Propagation Rate @ 50°C (k_p)	L/mol s	1270
Activation Energy (E_a)	kJ/mol	19.9
Arrhenius Parameter(A)	L/mol s	2.1*10^6

Regulatory[2]	
Germany (REACH)	YES
Switzerland (CHEMINV)	YES
US (TSCA)	YES
Canada (DSL)	YES
Japan (ENCS)	YES
South Korea (ECL)	YES
Australia (AICS)	YES
Philippines (PICCS)	YES
China (IECSC)	YES
New Zealand (NZIOC)	YES

[1]: Status 2020: Please refer to Technical Information Sheet (TI)
[2]: Status 2020. Please refer to Product Information Sheet (PIS)

Performance



Illustrations of hydrogen-bond interactions with UMA containing polymers.

UMA is a monomer composed of a mono-functionalized ethylene urea derivative possessing a polymerizable methacrylate group at one end. This functionality is the reason why UMA is a monomer building block that can excellently form hydrogen-bonds and dipolar interactions.

As a result, UMA is designed to improve adhesion, cohesion, non-covalent cross-linking and rheological properties of various polymers and polymer formulations. Properties that can be applied in coatings and adhesives.

Adhesion

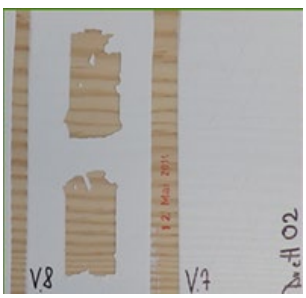
In BASF´s R&D labs, cross-cut wet adhesion tests according to DIN EN ISO 2409 were performed with UMA containing paints (active matter content: 1%) and control paints without UMA Those tests have proven that UMA containing polymer provides latex paints with excellent wet-adhesion properties.

Wet adhesion test

Coated architectural paint on clean substrate was dried for 7 days. Diamond-cut was performed followed by 120 min water exposure and 10 min drying. Tesa® tape is firmly stuck on substrate and pulled off rapidly

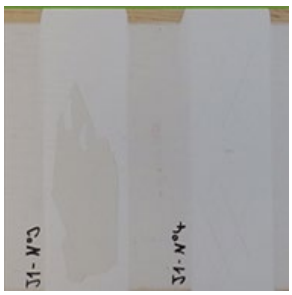
Wet adhesion test results

(A) Wood (Pinewood)



w/o UMA with UMA

(B) Alkyd Primer



w/o UMA with UMA

(C) Steel

w/o UMA with UMA

Paints with UMA containing polymer binder show superior wet-adhesion properties.
UMA promotes adhesion to common and critical substrates also after water immersion or exposure to high humidity. The risk of delamination and flaking of the applied coating is largely reduced.

Cohesion (load-bearing capacity): Time for a 1 kg weight suspended to the PSA film (Acrylic PSA, Tg: ~ -30 °C) on steel to fall off (23 °C, 50% rel. humidity).

	Cohesion [h]
PSA film, no UMA	0.7
PSA film, 1 wt% UMA (BOTM)	> 100
PSA film, 2 wt% UMA (BOTM)	> 100

Pressure-sensitive adhesives (PSAs) show a largely improved cohesive strength (load-bearing capacity) with small effective use levels of UMA.
The test was stopped after 100 h. It is assumed that improved intrinsic polymer interactions induced by the ureido functionality of UMA boost boost the cohesive properties of the PSA films.

Cohesion Test

The cohesion (load-bearing capacity) of pressure-sensitive adhesives (PSA) films with and without incorporated UMA was tested in BASF´s R&D labs.

A PET film (25 x 25 mm^2) was coated with 75 g/m^2 pressure sensitive adhesive (PSA). The cohesion was measured as load-bearing capacity. That means the time was measured until a 1 kg weight suspended to the PSA film on steel falls off (FTM 8 FINAT-Test Method). For PSA films with increasing amounts of UMA (1% and 2 % active matter) the test results are shown in the table (left site).

Appendix: Guiding Recipe

UMA in All Acrylic Dispersions

Target application: Binder for Architectural Paints and Coatings

Target T_g: 5-15 °C

Applied monomers

Ureido methacrylate (2.0 wt%), Methyl methacrylate (53.1 wt%), Butyl acrylate (42.9 wt%), Acrylamide (0.5 wt%), Acrylic acid (1.5 wt%)

Reactor Charge (1)	
Demineralized water	250.0 g
Lutensol AT 18	2.5 g[1)]
Sodium dodecyl sulfate	9.0 g[1)]
Pre-Emulsion (3)	10.0 g
Initiator Feed (2)	15.0 g

Initiator Solution (2)	
Demineralized water	100.0 g
Sodium persulfate	0.75 g

Pre-Emulsion (3)	
Demineralized water	120.0 g
Lutensol AT 18	3.8 g[1)]
Sodium dodecyl sulfate	0.3 g[1)]
Ureido methacrylate	5.0 g[1)]
Acrylic acid	3.8 g
Acrylamide	2.1 g[1)]
Methyl methacrylate	165.0 g
Butyl acrylate	210.0 g

Pre-Emulsion (4)	
Demineralized water	56.0 g
Lutensol AT 18	3.8 g[1)]
Sodium dodecyl sulfate	1.0 g[1)]
Methyl methacrylate	125.0 g
Ureido methacrylate	5.0 g[1)]
Acrylic acid	3.8 g
Acrylamide	0.4 g[1)]

1) = 100% active matter

Reaction

The reactor (a 2-litre glass reactor equipped with anchor stirrer (220 rpm), thermocouple, reflux condenser and feed vessels) is charged with components (1), 10.0 g of the pre-emulsion (3), 15.0 g of the initiator solution (2) and heated up to 85°C. After 10 minutes at 85 °C, the remaining pre-emulsion (3) and 64.4 g of the initiator solution (2) are pre-mixed and fed to the reactor within 1.5 h at 85 °C. After completing the addition, pre-emulsion (4) and 21.4 g of the initiator solution (2) are pre-mixed and fed to the reactor within 30 min at 85 °C. After completion of the addition, the reaction mixture is stirred for 2 h at 85 °C.

Post Reaction

The reaction mixture is cooled down to ambient temperature, neutralized with aqueous ammonia solution and filtered over a 125 µm filter.

Analytics

Residual monomer: < 1000 ppm
T_g: 6 °C
Particle diameter: ~90 nm
Solid content: 50 wt%

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