

Product Data Sheet

DYHARD® CU-Line

DYHARD® 100 series

The DYHARD® 100 series consists of different micronized grades of dicyandiamide curing agents for the formulation of thermosetting epoxy resin compositions.

They contain up to 3 % of inert anti-caking agent in order to prevent agglomerations and to improve handling.

DESCRIPTION

The products of the DYHARD® 100 series do not react with epoxy resins at moderate temperatures. Dispersed in epoxy resin the mixture remains stable until activated by heat. Without accelerator, a curing temperature of about 180 °C is required. This gives the opportunity to store a complete formulation for months or even years. If an accelerator is used, shelf life will vary depending on the type and quantity of accelerator.

The products of the DYHARD® 100 series differ in particle size and inert anti-caking agent content. The anti-caking agent prevents re-agglomeration of the fine powder. In consequence the small particle sizes prevent settling in the epoxy resin during storage providing a homogeneous cure of the formulated system without forming so-called "hot spots".

MIXING RATIO

The stoichiometric mixing ratio of an epoxy resin with a dicyandiamide curing agent is calculated as follows:

Parts of curing agent (weight) per 100 parts of epoxy resin (weight)

$$= \frac{\text{EW of hardener} \times 100}{\text{EEW of epoxy resin}}$$

EW means "Equivalent Weight" of the curing agent. The EW of dicyandiamide has been determined by laboratory experiments and is 12 – 14 g/eq.

EEW means "Epoxy Equivalent Weight" of the resin or resin mixture used.

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PRODUCT PORTFOLIO

DYHARD® 100	98 % max. 40 µm	(ACA* 1,5 %)
DYHARD® 100M ¹	98 % max. 40 µm	(ACA* 1,5 %)
DYHARD® 100S	98 % max. 10 µm	(ACA* 1,5 %)
DYHARD® 100SH	98 % max. 10 µm	(ACA* 3,0 %)
DYHARD® 100SF	98 % max. 6 µm	(ACA* 3,0 %)

¹ Only available in the USA

* ACA = Anti-Caking Agent (amorphous silica)

ADVANTAGES

- Particle sizes from 98 %; <40 µm to 98 %; <6 µm available, the selection depends on the requirements of the desired application; finer particle sizes show maximum reactivity
- Products can be easily dispersed in liquid epoxy resins
- Highly latent, pot life more than 24 months at 23 °C in epoxy resins
- Cost effective due to low dosage rate
- Low toxicity, not corrosive, not skin irritant
- The activation temperature can be easily influenced from 180 °C down to 70 °C using the appropriate DYHARD® CAT-Line accelerator
- DYHARD® 100 series products give very dense polymer networks, which leads to high temperature- and high chemical resistance

The products for the DYHARD® 100 series can also be supplied as predispersed pastes. For information on these products, please refer to the product data sheets of our DYHARD® MB-Line

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With accelerators from the DYHARD® CAT-Line the curing temperature of the products of the DYHARD® 100 series can be reduced, while maintaining the good properties of the cured epoxy resin. There are two classes of accelerators available:

DYHARD® Urons

Blocked accelerators, which provide long shelf lives of one-component resin systems at curing temperatures > 80 °C.

DYHARD® Imidazoles

Unblocked accelerators that provide short curing times even at low temperatures > 70 °C and shelf lives of up to one week in formulated mixtures.

For the selection of the appropriate DYHARD® CAT-Line accelerators please refer to our corresponding product data sheets or contact our technical service.

TYPICAL APPLICATIONS

Products of the DYHARD® 100 series are widely used for all kinds of single component thermosetting epoxy resin formulations for:

- Composites based on prepregs in wind mills; for the automotive, sporting goods and aerospace industry
- Adhesives, e.g. also with structural performance
- Powder coatings, fusion bonded epoxy
- Encapsulation compounds and more

SPECIFICATIONS

DYHARD® 100-grade	DYHARD® 100 / 100M ¹	DYHARD® 100S	DYHARD® 100SH	DYHARD® 100SF
Particle size 98 %	max. 40 µm	max. 10 µm	max. 10 µm	max. 6 µm
Content of anticaking agent	max. 1.60 %	max. 1.60 %	max. 4.0 %	max. 4.0 %
Appearance	white powder	white powder	white powder	white powder
Assay of dicyandiamide	min. 97.3 %	min. 97.3 %	min. 94.8 %	min. 94.8 %
Content of water	max. 0.30 %	max. 0.30 %	max. 0.50 %	max. 0.50 %
Melting point without anticaking agent	209 - 212 °C	209 - 212 °C	209 - 212 °C	209 - 212 °C

¹ DYHARD® 100M is available in USA only

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FORMULATION EXAMPLES

The formulation examples below refer to a pure resin matrix only. Depending on the resin used, results may vary and differ from the values shown. Fillers and other additives to the resin matrix may change properties significantly.

Formulation	1	2	3	4
DYHARD® 100S	6.5 phr	6.5 phr	6.5 phr	6.5 phr
DYHARD® UR500	-	1.0 phr	3.0 phr	-
DYHARD® MI-FF	-	-	-	1.0 phr
Liquid bisphenol A epoxy resin (EEW 182 - 192)	100 parts	100 parts	100 parts	100 parts
Dyn. DSC – Onset [°C]	189	143	137	111
Dyn. DSC – Peak [°C]	197	151	144	130
Dyn. DSC – Final Tg [°C]	170	150	140	165
Gel time at 120 °C [min]	-	14	7	3
Gel time at 140 °C [min]	-	4	3	1
Gel time at 170 °C [min]	21	-	-	-
Latency (pot life) at 23 °C [days]	> 800	50	35	1
Latency (pot life) at 40 °C [days]	~ 600	~ 7	~ 7	-

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MECHANICAL PROPERTIES

The mechanical properties have been measured on cast resin plates. The results shown below refer to the formulation examples on page 4.

Note: With formulation No. 1 undamaged specimens cannot be obtained. The exothermic heat of the reaction leads to decomposition of the resin.

Formulation		2	3
Cure condition		2 hrs. 100 °C 2 hrs. 140 °C	3 hrs. 90 °C 2 hr. 130 °C
Tensile properties (ISO 527-2)			
Tensile modulus	MPa	3200	3000
Max. tensile strength	MPa	84	86
Elongation at tensile strength	%	6.2	6.0
Tensile strength at break	MPa	-	-
Elongation at break	%	-	-
3-point Flexural properties (ISO 178)			
Flexural modulus	MPa	3000	2950
Max. flexural strength	MPa	130	130
Elongation at flexural strength	%	7.5	6.5
Flexural strength at break	MPa	129	-
Elongation at break	%	8.5	-

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HEALTH & SAFETY PRECAUTIONS

Products out of the DYHARD® 100 series are not flammable, corrosive or explosive. They are not primary eye or skin irritant. Dicyandiamide will slowly decompose in water above 80 °C to generate ammonia, so materials should be kept dry and away from excessively hot and moist areas.

For additional health and safety information, please refer to the actual Material Safety Data Sheet.

PACKAGING & STORAGE

Depending on the different DYHARD® 100 product types, material is sold in different packaging ranging from 10 kg cardboard boxes to 15 kg paper bags. Alternative packaging such as big bags or smaller packaging can be made available on request.

Long storage and humidity may result in caking. Keep packaging tightly closed. The recommended storage times from date of delivery for each product are listed below.

DYHARD® 100-grade	DYHARD® 100	DYHARD® 100S	DYHARD® 100SH	DYHARD® 100SF
15 kg paper bag	12 months	6 months	-	-
10 kg cardboard box	-	12 months	12 months	6 months

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CONTACT

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