HUNTSMAN
Enriching lives through innovation

Advanced Materials

Araldite® CW 229-3 100 pbw
Aradur® HW 229-1 100 pbw

Liquid, brown, hot-curing two-component epoxy casting system with excellent crack resistance.
Prefilled with slightly abrasive, mechanically reinforcing fillers.

Applications

Indoor electrical insulation material for postinsulators, equipment parts, bushings, instrument and dry type distribution transformers, switchgears, etc.

Processing methods

Automatic pressure gelation process (APG).
Conventional gravity casting process under vacuum.

Properties

Outstanding mechanical and electrical properties combined with very high crack and thermal shock resistance due to the low coefficient of thermal expansion.
Qualified for encapsulation of large metal parts.

Resin

ARALDITE® CW 229-3

Viscosity	at 25°C	ISO 3219	Pa*s	80 - 200
	at 40°C	ISO 3219	Pa*s	8 – 17 *
Epoxy content		ISO 3001	equiv/kg	2.20 - 2.35 *
Density	at 25°C	ISO 1675	g/cm³	1.75 - 1.80
Filler content			% by weight	55 - 58
Flash point		ISO 1523	°C	180
Vapour pressure	at 20°C	(Knudsen)	Pa	appr. 10^{-3}
	at 60°C	(Knudsen)	Pa	appr. 5.10^{-2}

Hardener

ARADUR® HW 229-1

Viscosity	at 25°C	ISO 3219	Pa*s	7 - 20
	at 40°C	ISO 3219	Pa*s	1.5 – 5.5 *
Density	at 25°C	ISO 1675	g/cm³	1.90 - 2.00
Filler content			% by weight	62 - 65
Flash point		ISO 1523	°C	140
Vapour pressure	at 20°C	(Knudsen)	Pa	appr. 2.10^{-2}
	at 60°C	(Knudsen)	Pa	appr. 5

* Specified range

Remark

Prefilled liquid products always show a small filler sedimentation.

Before partial use we recommend to stir up carefully the components or to use each container as complete unit.

Storage

Store the components in a dry place in tightly sealed original containers. Under these conditions, the shelf life will correspond to the expiry date stated on the label. Partly emptied containers should be tightly closed immediately after use.
For information on waste disposal and hazardous products of decomposition in the event of fire, refer to the Material Safety Data Sheets (MSDS) for these particular products.

Processing (guideline values)

Araldite® CW 229-3 / Aradur® HW 229-1 100 : 100 pbw

System Preparation

General instructions for preparing prefilled resin systems
Long pot life is desirable in the processing of any casting resin system. Prefilled components help to shorten the mixing time considerably.
The two components will be mixed in the desired quantity under vacuum and at slightly elevated temperature (50 - 60°C). For the mixing of medium- to high viscous casting resin systems and for mixing at lower temperatures, we recommend special thin film degassing mixers that may produce additional self-heating of 10-15 °C as a result of friction. Depending on quantity, mixer device, mixing temperature and application, the mixing time is, under a vacuum of 1 to 8 mbar, 0.5 to 2 h.
The premixed components packed according to their mixing ratio, could be used per container. In case of filler sedimentation, it is recommended to empty the container completely. Before partial use, the content must be carefully homogenized at elevated temperature. We recommend the same preheating temperature to prevent air enclosures when discharging the components.
In automatic mixing and metering installations, both components will be degased and ho-mogenized under a vacuum of about 2 mbar in the holding tanks. When degassed, the prefilled products are stirred up from time to time to avoid any sedimentation. After dosing and mixing with a static mixer, the system is fed directly to the vacuum chamber or, in the automatic pressure gelation process, directly into the hot casting mould. By using circular feeding tubes, several casting stations can be served.

Specific instructions

The effective pot-life of the mix is about 2 to 3 days at temperatures below 25°C. Conventional batch mixers should be cleaned once a week or at the end of work. For longer interruptions of work, the pipes of the mixing and metering installations have to be cooled and cleaned with the resin component to prevent sedimentation and/or undesired viscosity increase. Interruptions over a week-end (approx. 48h) without cleaning are possible if the pipes are cooled at temperatures below 18°C.

Viscosity increase and gel time at various temperatures, refer to Figs: 4.2 and 4.3.

Mould temperature

APG process	130 - 160°C
Conventional vacuum casting	70 - 100°C

Demoulding times (depending on mould temperature and casting volume)

APG process	10 - 40 min
Conventional vacuum casting	4 - 8h

Cure conditions (minimal postcure)

APG process	4h at 140°C
Conventional vacuum casting	8h at 130°C

To determine whether crosslinking has been carried to completion and the final proper-ties are optimal, it is necessary to carry out relevant measurements on the actual object or to measure the glass transition temperature. Different gel and postcuring cycles in the manufacturing process could influence the crosslinking and the glass transition tempera-ture respectively.

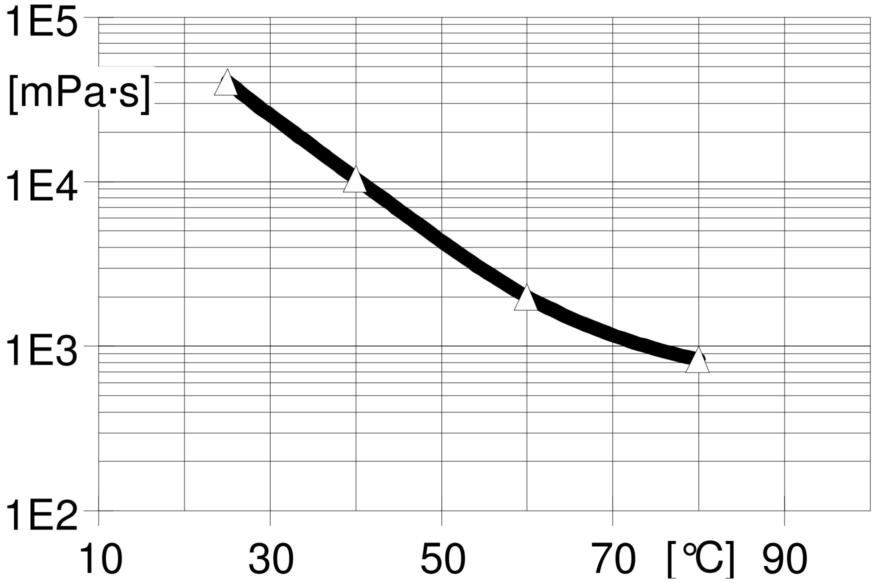

Fig.4.1: **Initial viscosity as a function of temperature**
(measurements with Rheomat 115, D = 10 s^{-1})

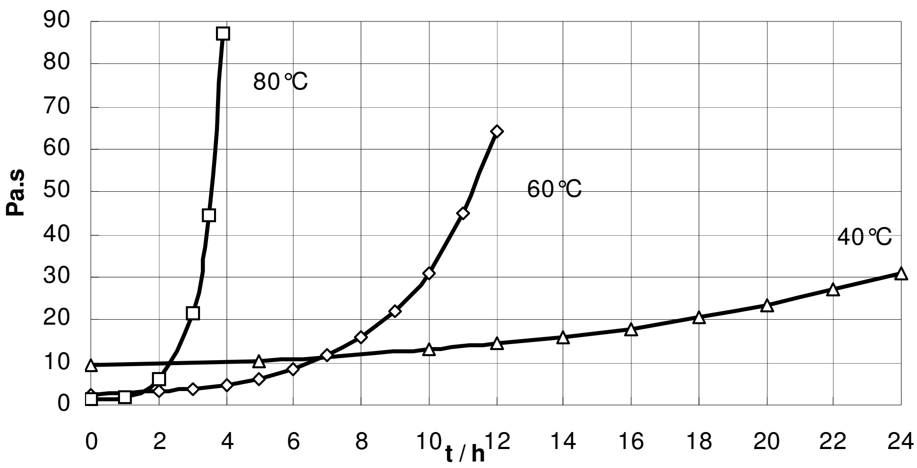

Fig.4.2: **Viscosity increase at 40, 60 and 80°C**
(measurements with Rheomat 260, MS 125, shear rate D = 10 s^{-1})

Gelation-/cure times

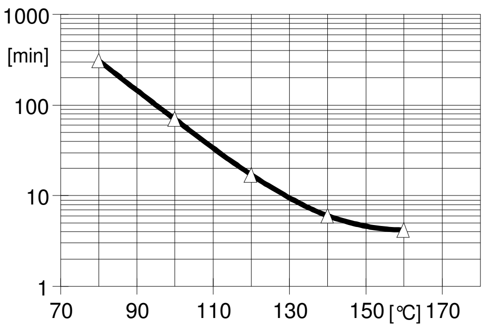

Fig.4.3: **Geltime measured as a function of temperature**
(measurements with Gelnorm Instrument / ISO 9396)

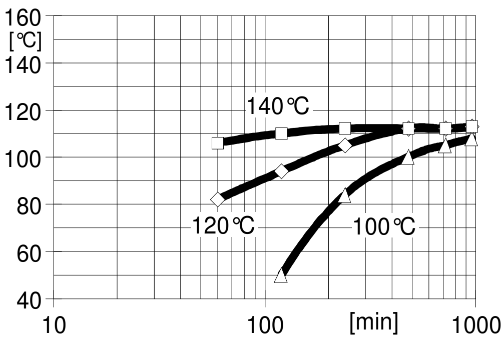

Fig.4.4: **Glass transition temperature as a function of cure time**
(isothermic reaction, ISO 11357-2)

Mechanical and Physical Properties (guideline values)

Determined on standard test specimen at 23°C
Cured for 10h at 80°C + 10h at 140°C

Tensile strength	ISO 527	MPa	80 - 90
Elongation at break	ISO 527	%	1.3 - 1.5
E modulus from tensile test	ISO 527	MPa	10000-11000
Flexural strength at 23°C	ISO 178	MPa	120 - 130
at 80°C	ISO 178	MPa	100 - 110
Surface strain at 23°C	ISO 178	%	1.4 - 1.6
at 80°C	ISO 178	%	2.2 - 2.4
E modulus from flexural test	ISO 178	MPa	9600 - 10000
Compressive strength	ISO 604	MPa	170 - 190
Compression set	ISO 604	%	11 - 14
Impact strength	ISO 179	kJ/m²	9 - 11
Double Torsion Test	CG 216-0/89		
Critical stress intensity factor (K_{IC})		MPa·m$^{1/2}$	2.8 - 3.0
Specific energy at break (G_{IC})		J/m²	670 - 750
Martens temperature	DIN 53458	°C	100 - 110
Heat distortion temperature	ISO 75	°C	105 - 115
Glass transition temperature (DSC)	ISO 11357-2	°C	110 – 125 *
Coefficient of linear thermal expansion	ISO 11359-2		Fig. 6.2
Mean value for temperature range: 20-80°C		K^{-1}	27 – 30.10^{-6}
Thermal conductivity similar to	ISO 8894-1	W/mK	0.65 - 0.75
Flammability (Burningtime/-length)	ISO 1210	s/mm	57 / 11
Flammability	UL 94		
Thickness of specimen: 4 mm		class	HB
Thickness of specimen: 12 mm		class	V1
Thermal endurance profile (TEP)	IEC 60216		Fig. 8.1 - 8.4
Temperature index (TI): weight loss	(20000h/ 5000h)	°C	TI 186 / 210
Temperature index (TI): flexural strength	(20000h/ 5000h)	°C	TI 201 / 234
Thermal ageing class (20000h)	IEC 60085	class	H
Thermal endurance RTI: tensile strength	UL 746B	°C	200
Water absorption (specimen: 50x50x4 mm)	ISO 62		
10 days at 23°C		% by wt.	0.10 - 0.20
60 min at 100°C		% by wt.	0.10 - 0.20
Decomposition temperature (heating rate: 10K/min)	TGA	°C	400
Density (Filler load: 61% by wt.)	ISO 1183	g/cm³	1.80 - 1.90

* Specified range

Mechanical and Physical Properties (guideline values)

Determined on standard test specimen at 23°C
cured for 10h at 80°C + 10h at 140°C

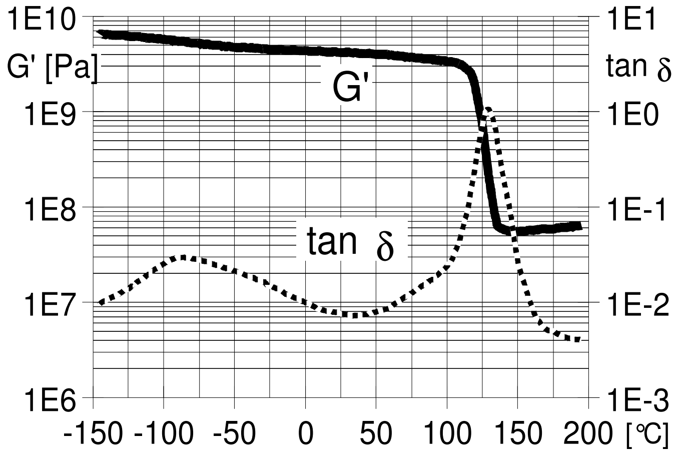

Fig.6.1: **Shear modulus (G') and mechanical loss factor (tan δ) as a function of temperature**
(ISO 6721-7,methode C, measured at 1Hz)

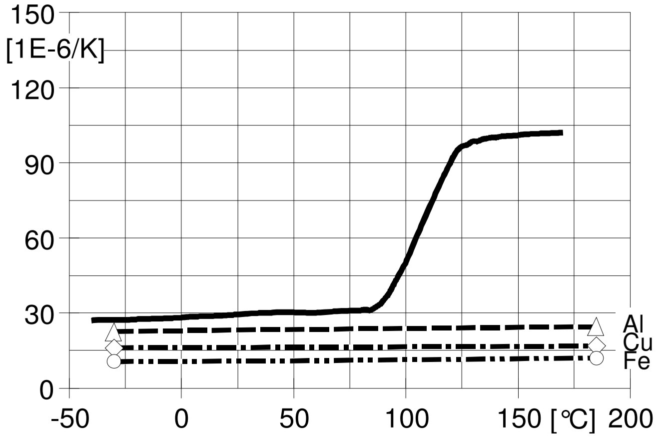

Fig.6.2: **Coefficient of linear thermal expansion (α) as a function of temperature**
(ISO 11359-2/ reference temperature: 23°C)

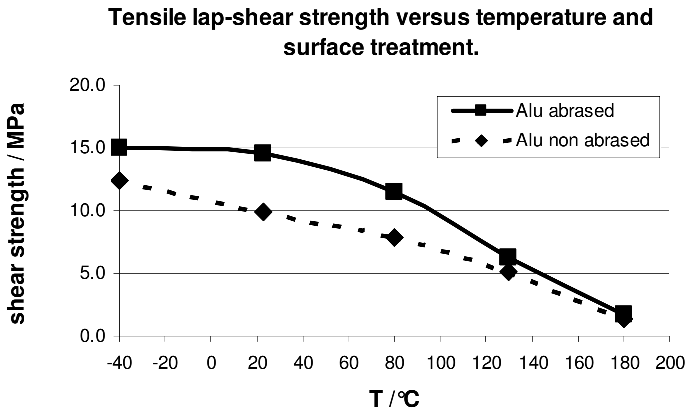

Fig.6.3: **Tensile lap-shear strength (MPa) vs. temperature and surface treatment (T/°C)**

Electrical Properties (guideline values)

Determined on standard test specimen at 23°C
cured for 10h at 80°C + 10h at 140°C

If electrically stressed structural components are to be used under difficult climatic conditions (cf. IEC 60932), the complete installation must be tested climatically under maximum working load.

Breakdown strength	IEC 60243-1	kV/mm	18 - 22
Diffusion breakdown strength	DIN VDE 0441-1	class	HD 2
Temperature of specimen after test		°C	≤ 23
HV arc resistance	IEC 61621	s	93 – 125
Tracking resistance	IEC 60112		
with test solution A		CTI	>600-0.0
with test solution B			--
Electrolytical corrosion effect	IEC 60426	grade	A-1

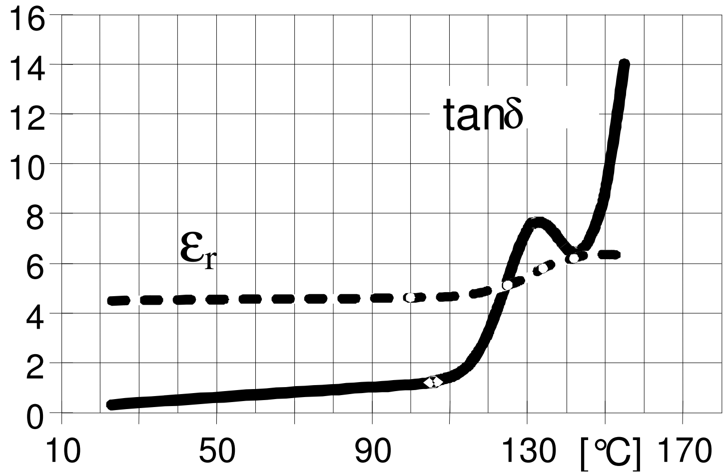

Fig.7.1: **Loss factor (tan δ) and dielectric constant (εr) as a function of temperature**
(measurement frequency: 50 Hz / IEC 60250)

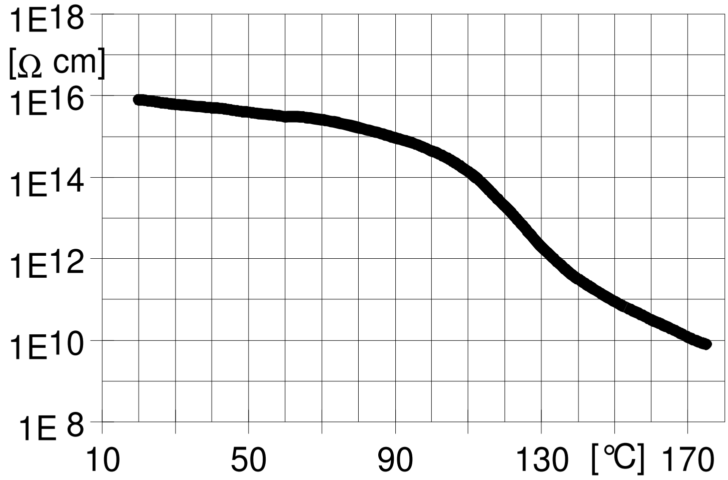

Fig.7.2: **Volume resistivity (ρ) as a function of temperature**
(measurement voltage: 1000 V/ IEC 60093)

Special Properties (guideline values)

Thermal Endurance Profile acc. IEC 60216

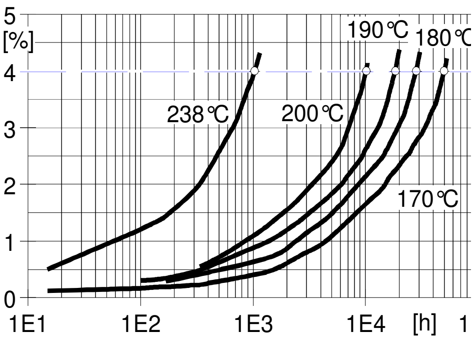

Fig.8.1: **Weight loss**
(specimen: 50x50x3 mm, limit: 4.0%)

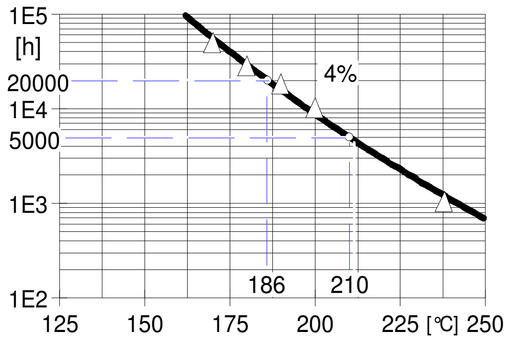

Fig.8.2: **Temperature Index 186 / 210**
(weight loss)

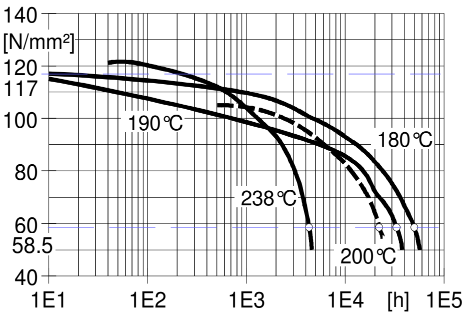

Fig.8.3: **Loss of flexural strength**
(ISO 178, limit: 50%)

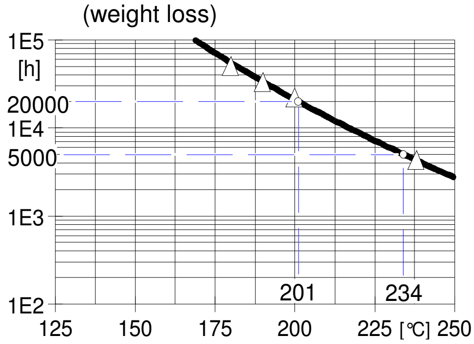

Fig.8.4: **Temperature Index 201 / 234**
(flexural strength)

Mechanical values

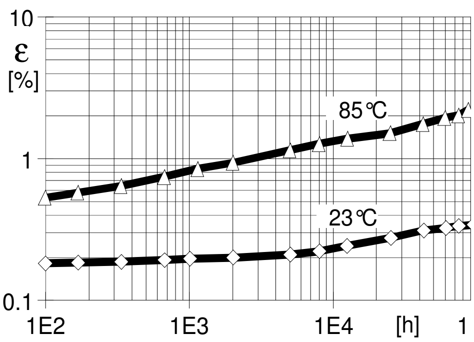

Fig.8.5: **Elongation (ε) as a function of temperature at 23 and 85℃**
(Tensile strain: 20 MPa , ISO 899)

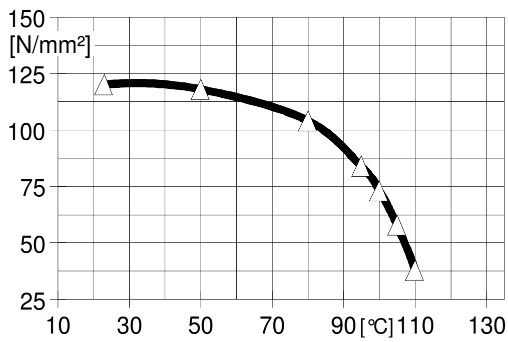

Fig.8.6: **Flexural strength as a function of temperature**
(ISO 178)

Crack Resistance / Combustion Products

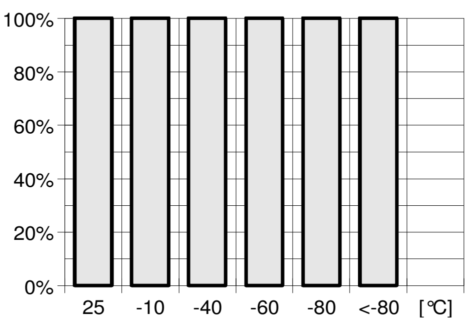

Fig.8.7: **Crack resistance/ Temperature cycling test**
Passed specimen (%) = f (temp. steps)
No crack registered till -80℃
Embedded metal part, edge radius 1 mm

Gas	Amount (ppm)
CO_2	21000
CO	5400
H_2S	<3
NH_3	<3
HCOH	<5
HCl	<10
CH_2CHCN	<20
SO_2	<5
NO + NO_2	<5
HCN	<8
HBr	<5
HF	<5

Fig. 8.8 **Combustion Products**
according CEI 60020-37, part 2
Tested by IMQ, Milano, Italy
Full test report available on request

Legal Notice

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