

New styrene-free lamination resin for pipe joining, fittings and repair

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Pipe fitting, joining and repair

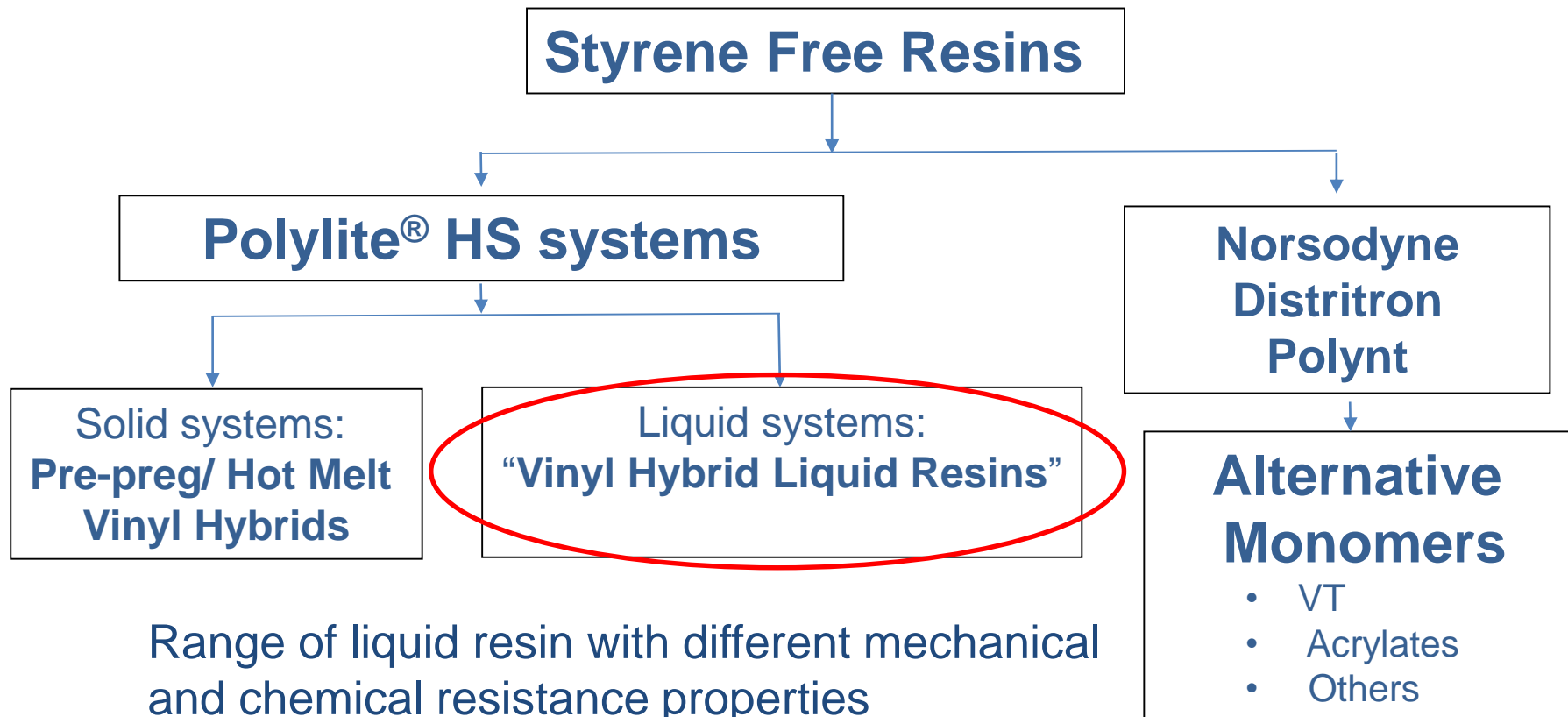
- ❑ Demanding structural application requiring chemical resistance together with good thermal and mechanical properties
- ❑ Application requires high productivity any new product solutions must meet the existing requirements and fit in the existing processes and designs
- ❑ Product needs to be user friendly and suitable for hand lay up/ spray up where laminate thickness can be high
- ❑ Pipe fitting/ joining or rehabilitation can take place in confined places (inside a pipe) and in production areas where adequate ventilation can be difficult to arrange
- ❑ Although small volume speciality application still an integral part of the pipe manufacturing process



Picture courtesy of Flowtite Technology As

Polylite® HS technology

- ❑ Polylite® HS resins are based on reactive diluent free vinyl hybrid resin technology
- ❑ Base resins do not include styrene, very low emissions.
- ❑ Radical cure as traditional UP and VE resins.



VH-1233 & VH-1248 platforms

- ☐ Urethane modified Vinyl Hybrid lamination resins with medium cross-linking density
- ☐ Styrene free, very low emission
 - "ADR non hazardous", Flash point > 93 %
 - Enables emission/ "odour free" end product
- ☐ Suitable for hand lay up and spray up
- ☐ CHP/MEKP blend (MCP-75) cure
- ☐ Very good thermal and mechanical properties
 - TS > 70 Mpa
 - TM > 4000 Mpa
 - TE 3 %
 - FS > 130 Mpa
 - FM > 4000 Mpa
 - Ultimate HDT > 90 °C
 - Barcol 50
- ☐ Good retention of wet mechanical properties
- ☐ Good adhesion on a cured GRP laminate
- ☐ Pipe fitting, joining and repair
 - VH-1233 thixotropic & preaccelerated (fitting & joining)
 - VH-1248 thixotropic & non accelerated (repair)

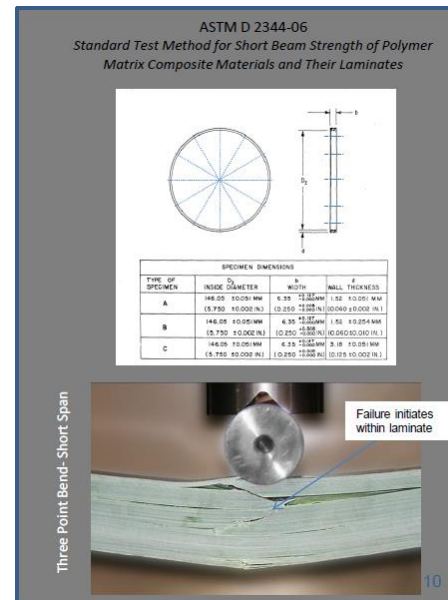
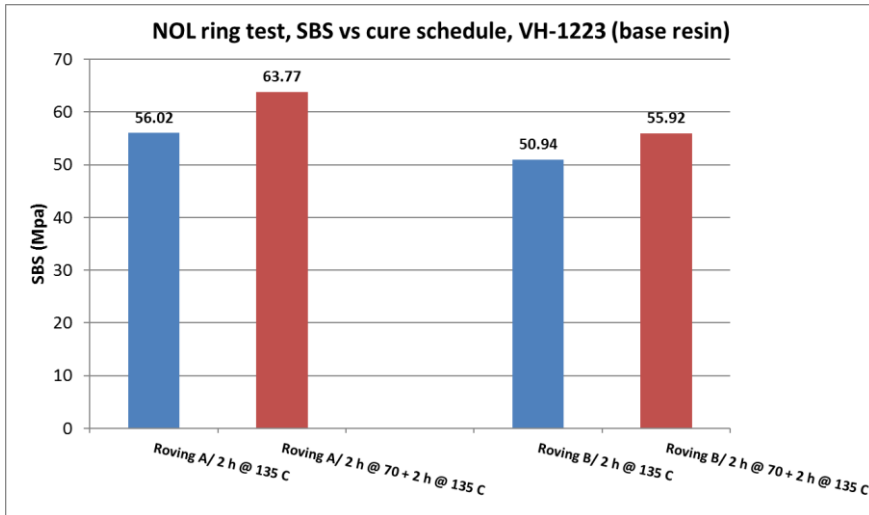


VH-1233 & VH-1248 platforms

❑ Laminate mechanical testing, 7 days @ RT

VH-1233 + CSM		VH-1233 + stitched CSM	
Tensile Modulus(MPa)	Tensile Strenght(Mpa)	Tensile Modulus(MPa)	Tensile Strenght(Mpa)
8603.6	126.0	9423.5	138.9
VH-1233 + NCF 800 (0/-45/+45), 34.7 %-w		VH-1248 + NCF 800 (0/-45/+45), 35.3 %-w	
Tensile Modulus(MPa), 90°	Tensile Strenght(Mpa), 90°	Tensile Modulus(MPa), 90°	Tensile Strenght(Mpa), 90°
7946.6	120.8	8124.0	118.9

❑ Sizing compatibility, NOL ring testing



VH-1233 & VH-1248 platforms

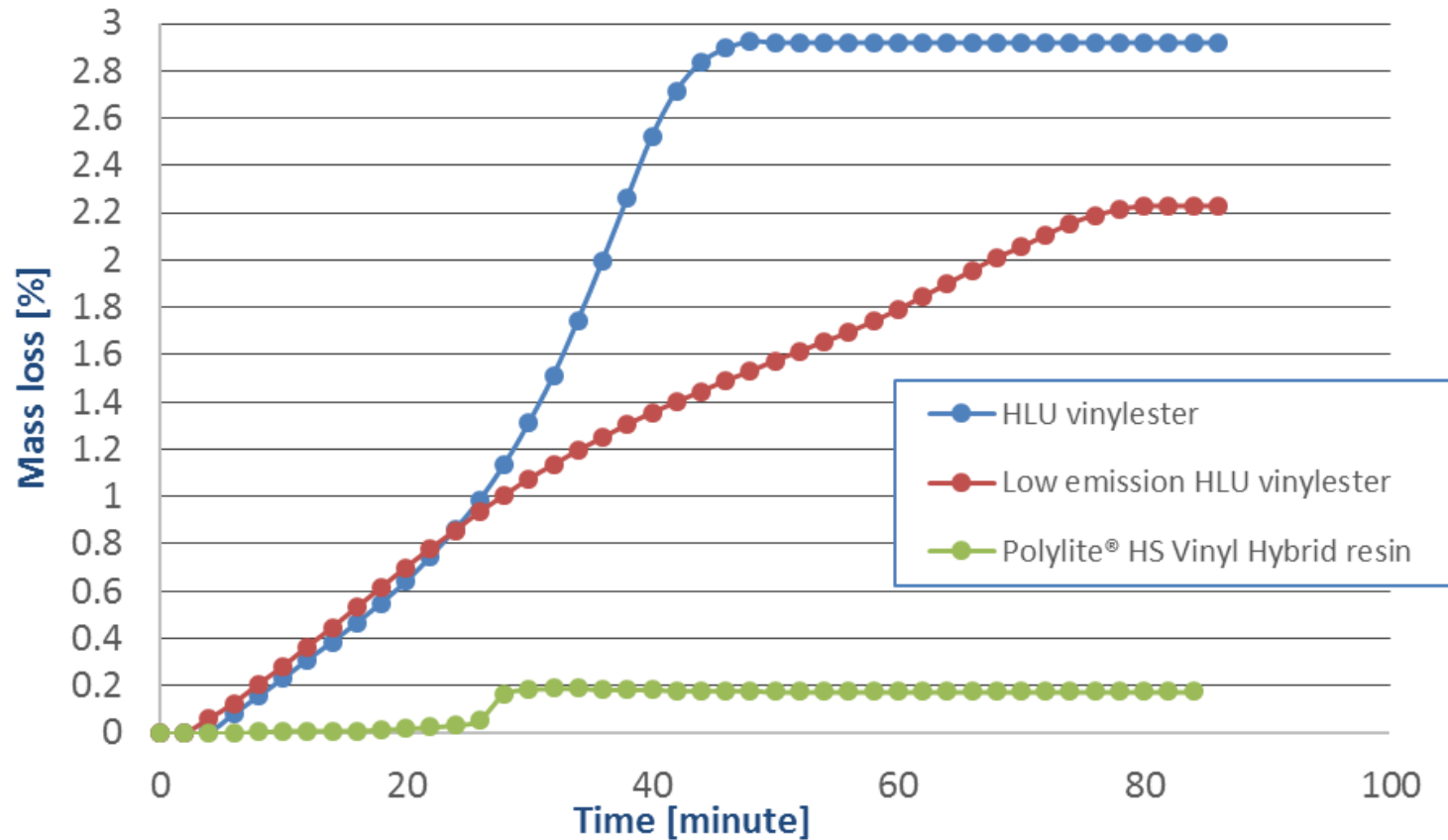
❑ Amiblu laminate exposure testing

	Laminate aged at 40°C	
	VH 1233 distilled water	VH 1233 Acid water 5% H ₂ SO ₄
Retained TS after 11784 hrs (%)	86.1	81.5
Retained TM after 11784 hrs (%)	80.0	77.6
	Clear cast aged at 40°C	
	VH 1233 distilled water	VH 1233 Acid water 5% H ₂ SO ₄
Retained FS after 4440 hrs (%)	68.1	59.6
Retained FM after 4440 hrs (%)	77.8	76.9
	Mass change at 40°C	
	VH 1233 distilled water	VH 1233 Acid water 5% H ₂ SO ₄
Mass change after 12936 hrs (%)	2.94	2.72














Table courtesy of Flowtite Technology As

EHS considerations, emissions

Emission comparison



EHS considerations, "label elements "

	VH-1233	ISO-UPR	EPOXY LAMINATION RESIN	UPR HARDENER	EPOXY LAMINATION HARDENER
Description	Styrene free Vinyl Hybrid resin	Typical hazard statement, styrenated polyester resin	Typical hazard statement, low viscosity lamination epoxy resin	Typical hazard statement organic peroxide initiator (MEKP) Typical organic peroxide initiator dosage is 1-2 phr	Typical hazard statement, lamination epoxy hardener. Please note, due to diversity of different amines used there is no such thing as a one standard system
Hazard Statements	 H317	   H315, H319, H332, H335, H361d, H372, H412, H226	  H315, H317, H319, H411	   H242, H314, H302 + H332	    H302 (+H312) H314, H317, (H373, H361f) H411 / 412

H226 – Flammable liquid and vapour

H242 – Heating may cause a fire

H302 – Harmful if swallowed

H312 – Harmful if in contact with skin

H314 – Causes severe skin burns and eye damage

H315 – Causes skin irritation

H317 – May cause an allergic skin reaction

H319 – Causes serious eye irritation

H322 – Harmful if inhaled

H335 – May cause respiratory irritation

H361d / f – Suspect of damaging the unborn child (d) / fertility (f)

H372 – Causes damage to hearing through prolonged or repeated exposure if inhaled

H373 – May cause damage to organs through prolonged or repeated exposure

H411 – Toxic to aquatic life with long lasting effects

H412 – Harmful to aquatic life with long lasting effects

EHS considerations, skin sensitisation

❑ Skin sensitisation potency, EC3 value

- The EC3 value, interpolated from the dose response, is the effective concentration of the test substance required to produce a three-fold increase in the stimulation index compared to vehicle-treated controls.

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Potency categorization of classified skin sensitizers based on LLNA

EC3 value (%)	EC WG sens & SCCP	CLP & GHS (H317 former R43)	EC3 value (%)	ECETOC
≤0.2	extreme	1A	<0.1	extreme
>0.2 - ≤2	strong	1A	≥0.1 - <1	strong
>2	moderate	1B	≥1 - <10	moderate
			≥10 - ≤100	weak

EC3 value: the amount of a chemical that is required to elicit a three-fold increase in lymph node cell proliferative activity (SI ≥ 3)

Baskett et al 2005; SCCP 2005; Guidance on the Application of the CLP Criteria ver 4 2013; GHS 5th rev 2013; ECETOC 2003

2015-07-01 SCCS WG on methodologies | Carola Lidén | 7

SOURCE:

http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_miwg_226_rd1.pdf

❑ EC3 values as documented in the REACH dossiers:

- VH-1233
 - 1,4 BDDMA (*) 31,4%
- Typical room temperature lamination epoxy resin, resin component - a blend of "Bis-A & -F epoxies"
 - BADGE (**) 5,7 %
 - BPFDE (***) 0,7 %

*) CAS 2082-81-7

**) CAS 25068-38-6

***) CAS 9003-36-5

Process considerations

- ❑ Application properties similar to traditional styrenated resins
- ❑ Good fibre compatibility
- ❑ Complex geometries laminates require traditional chopped strand mat binder compatibility improvements
 - Binder free mats
 - Compatible binder has been developed and is under testing
- ❑ "Higher than UPR/VER" air inhibition and due to very low VOC there won't be "physical drying"



- ❑ Improved adhesion on an old GRP pipe
 - Still requires a good grinding
- ❑ Good secondary adhesion
- ❑ Slightly slower glass wetting, but comparable laminate glass content and mechanical properties typically achieved

- ❑ Thoroughly tested for pipe fitting



Picture courtesy of Flowtite Technology As



Summary

- ❑ Pipe fitting, joining and repair are demanding structural applications where the lamination might require working in confined / inadequately ventilated production areas
- ❑ PolyLite® HS resins are a series of radical cure, high performance resins enabling a significant emission reduction
- ❑ VH-1233 & VH-1248 are lamination resins specially designed for secondary pipe lamination applications enabling:
 - Very low emission
 - Good application properties
 - Fit to existing processes
 - Good adhesion
 - Thermal and mechanical properties required
 - Good retention of the mechanical properties
- ❑ VH-1233 & VH-1248 skin sensitization potential according to the EC3 value is lower than with a typical epoxy room temperature lamination resin
- ❑ PolyLite® HS resins are typically well compatible with the existing commercial glass fibre reinforcements on the market, a more compatible CSM binder is under development

Thank you!