Technical data sheet

STYPOL®

# ArmorStar® VSXH

## MACT-Compliant Vinyl Ester Blend

## Skin Coat Laminating Resin



### Type

ArmorStar® VSXH is pre-promoted, vinyl ester blended resin containing styrene monomer. It is formulated for building reinforced plastic parts using open mold processes such as hand lay-up and spray-up. ArmorStar® VSXH is specifically formulated for rapid cure and hardness development in thin laminates, making it ideal for use as a skin laminate in marine and tooling applications.

### Distinguishing Characteristics

ArmorStar®VSXH offers the following features:

- Excellent mechanical properties
- Exceptional cosmetics (low fiber print)
- Good blister resistance for marine applications
- Superior heat resistance for long term durability in FRP molds
- Excellent cure in thin laminates for quick cycle times
- Easy application, wet out and air removal.

**ArmorStar® VSXH** meets the EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) for Boat Manufacturing and Reinforced Plastic Composites Production.

### Typical Liquid Properties (at 77°F)

Typical liquid properties of standard **ArmorStar® VSXH** products are shown below. These values may or may not be manufacturing control criteria; they are listed for a reference guide only. Particular batches will not conform exactly to the numbers listed because storage conditions, temperature changes, age, testing equipment (type and procedure) can each have a significant effect on the results. Products outside of these readings can perform acceptably. Final suitability of this product is in the end use performance. For other versions see the liquid properties datasheet for actual values.

| Test | ArmorStar® VSXH |
|---|---|
| Viscosity[2] | 550 cps |
| Thixotropic Index | 3.0 |
| Weight per Gallon | 9.1 lbs |

[1]For HAP and Monomer content information please refer to the MSDS
[2]Brookfield RV #2 at 50 rpm.

Standard **ArmorStar® VSXH** products are available in 22, 27 and 32 minute gel times. These gel times are based on a 100 g mass catalyzed with 1.5% Arkema Luperox® DHD-9.

## Physical Properties

The physical properties of **ArmorStar® VSXH** are shown below. Properties are shown for both neat resins casting and for a glass fiber reinforced laminates. These are typical values and are provided for reference only.

Note: The physical properties of thermoset resins evolve as the resin cures. The properties given below are for well cured castings and laminates. Resin and laminates at different stages of cure will have varying properties.

| Test | Test Method[1] | Neat Resin Casting[2] | Laminate[3] |
|---|---|---|---|
| **Tensile Strength** | ASTM D638 | 9,500 psi | 16,000 psi |
| **Tensile Modulus** | | 580,000 psi | 1,460,000 psi |
| **Tensile Elongation** | | 2.4% | 1.6% |
| **Flexural Strength** | ASTM D790 | 16,000 psi | 31,000 psi |
| **Flexural Modulus** | | 590,000 psi | 1,290,000 psi |
| **Glass Transition Temperature, Tg** | CCP-22-TAS-TM-3008 (DMA) | 230ºF (110ºC) | -- |

[1]All tests run per internal CCP test methods. These methods are similar to the ASTM Method listed above.
[2]Neat resin casting catalyzed with 1.5% Arkema Luperox® DHD-9. The casting cured for 16 hours at room temperature and was post cured for 4 hours at 150ºF.
[3]Laminate - Resin initiated with 1.5% Arkema Luperox® DHD-9. The laminate schedule was 2 plies of 1.5 oz. CSM. Glass content was 35-37%%. The panel was cured for 16 hours at room temperature and post cured for 4 hours at 150°F.

## Application

**ArmorStar® VSXH** should be mixed prior to use. Use mixing equipment with sufficient horsepower (relative to container size) to achieve thorough circulation from top to bottom and out to the sides of the container. The agitator must be properly sized for the container and must allow for uniform mixing regardless of the liquid level in the container. Mixing once a day for 10 minutes is typically sufficient. Air bubbling should not be used for mixing. It is not effective and only serves as a potential source of water or oil contamination. Do not over

mix **ArmorStar® VSXH.** Over mixing can break down the resin viscosity increasing the tendency to sag.

The cure rate of polyester resins depends on a number of factors including the product's age, temperature, catalyst type, catalyst level and ambient humidity. When used in a laminating application the laminate cure rate also depends on reinforcement content and laminate thickness as well as other factors. For these reasons, we recommend that customer's check the cure rate in your plant.

**ArmorStar® VSXH** is quality control tested using Arkema Luperox® DHD-9. However, **ArmorStar® VSXH** has been formulated to perform well with many different types of initiators. Initiators similar to Arkema Luperox® DHD-9 such as NOROX® MEKP-925 and NOROX® MEKP-925H, Akzo Nobel CADOX L-50a and Chemtura HP-90 are expected to yield similar performance. Other MEKP peroxides such as Arkema Luperox® DDM-9, Syrgis NOROX® MEKP-9 and Akzo Nobel CADOX D-50a Arkema Luperox® DHD-9, may also be used but cure time will vary.

A MEKP/CHP blended catalyst such as Syrgis Norox® MCP-75 can be used to control exotherm if your fabrication process requires building thick laminates with **ArmorStar® VSXH.** Use of a MEKP/CHP blended catalyst is not recommended for thin sections or during cool weather conditions. Use of a MEKP/CHP catalyst under these conditions can result in an inadequate cure. Use of straight CHP catalyst is not recommended.

To in determining the appropriate catalyst and level, CCP has investigated the effects of laminate thickness and temperature on cure of **ArmorStar® VSXH** laminates. The results of this investigation are presented in below.

All catalyst recommendations are based on the following criteria:

- Laminate peak exotherm of 150°F maximum
- Laminate Barcol hardness of 20 in less than 2 hours
- Laminate gel time of 25 to 45 minutes

**ArmorStar® VSXH Catalyst Chart**

| | | Laminate Thickness | | |
|---|---|---|---|---|
| Straight MEKP's | Catalyst | (<0.250") | (>0.250") | Temperature Range, °F |
| | Luperox® DHD-9 | 1.2-2.25 | NR | 60-95 |
| | Crompton HP-90 | 1.2-2.25 | NR | 60-95 |
| Low CHP Blends | Luperox® KC-70 | NR | 1.25-2.0 | 75+ |
| | Luperox® Cat 730 | NR | 1.25-2.0 | 75+ |
| | Norac MCP 75 | NR | 1.25-2.0 | 75+ |
| High CHP Blends | Luperox® KC-50 | NR | 1.8-3.5 | 95+ |

| | | | |
|---|---|---|---|
| Luperox® Cat 11 | NR | 1.8-3.5 | 95+ |
| Norac MCP | NR | 1.8-3.5 | 95+ |

## Important Note

Under no circumstances should the MEKP catalyst level exceed 2.5% or fall below 0.75% Contact your catalyst supplier or you CCP representative for acceptable catalyst ranges for MEKP/CHP blends. **ArmorStar® VSXH** should not be used when temperature conditions are below 60°F, as curing may be adversely affected.

## Caution

Do not add any material, other than the recommended organic peroxide, to this product without the advice of a representative of CCP Composites US.

## Storage

**ArmorStar® VSXH** has a shelf life of three months from date of shipment from CCP when stored at 73°F or below in a closed, factory-sealed, opaque container, and out of direct sunlight. The usage life is cut in half for every 20°F over 73°F.

**CCP COMPOSITES US**
**WARRANTIES, DISCLAIMERS AND LIMITATION OF LIABILITY (Rev. 10/11)**

Seller warrants that: (i) Buyer shall obtain good title to the product sold hereunder, (ii) at Shipment such product shall conform to Seller's specifications; and (iii) the sale or use of such product will not infringe the claims of any U.S. patent covering the product itself, but Seller does not warrant against infringement which might arise by the use of said product in any combination with other products or arising in the operation of any process. **SELLER MAKES NO OTHER WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, EVEN IF THAT PURPOSE IS KNOWN TO SELLER. ANY APPLICATION INFORMATION OR ASSISTANCE WHICH SELLER MAY FURNISH TO BUYER IS GRATUITOUS AND SHALL IN NO WAY BE DEEMED PART OF THE SALE OF PRODUCT HEREUNDER OR A WARRANTY OF THE RESULTS OBTAINED THROUGH THE USE OF SUCH PRODUCT.**

Without limiting the generality of the foregoing, if any product fails to meet warranties mentioned above, Seller shall at Seller's option either replace the nonconforming product at no cost to Buyer or refund the Buyer the purchase price thereof. The foregoing is Buyer's sole and exclusive remedy for failure of Seller to deliver or supply product that meets the foregoing warranties. Seller's liability with respect to this contract and the product purchased under it shall not exceed the purchase price of the portion of such product as to which such liability arises. Seller shall not be liable for any injury, loss or damage, resulting from the handling or use of the product shipped hereunder whether in the manufacturing process or otherwise. In no event shall Seller be liable for special, incidental or consequential damages, including without limitations loss of profits, capital or business opportunity, downtime costs, or claims of customers or employees of Buyer. Failure to give Seller notice of any claim within thirty (30) days of shipment of the product concerned shall constitute a waiver of such claim by Buyer. Any product credit received by Buyer hereunder, if not used, shall automatically expire one (1) year from the date the credit was granted. Notwithstanding any applicable statue of limitations to the contrary, any action by Buyer relation to a claim hereunder must be instituted no later than two (2) years after the occurrence of the event upon which the claim is based. All the foregoing limitations shall apply irrespective of whether Buyer's claim is based upon breach of contract, breach of warranty, negligence, strict liability, or any other legal theory.

## COMPOSITES SAFETY INFORMATION
## (October 2011)

All sales of products manufactured by CCP Composites US (CCP), and described herein, are made solely on condition that CCP's customers comply with applicable health and safety laws, regulations and orders relating to the handling of our products in the workplace. Before using, read the following information, and both the product label, and Material Safety Data Sheet pertaining to each product.

Most products contain styrene. Styrene can cause eye, skin and respiratory tract irritation. Avoid contact with eyes, skin and clothing. Impermeable gloves, safety eyewear and protective clothing should be worn during use to avoid skin and eye contact. Wash thoroughly after use.

Styrene is a solvent and may be harmful if inhaled. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Extended exposure to styrene at concentrations above the recommended exposure limits may cause central nervous system depression causing dizziness, headaches or nausea and, if overexposure is continued indefinitely, loss of consciousness, liver and kidney damage.

Do not ingest or breathe vapor, spray mists or dusts caused by applying, sanding, grinding and sawing products. Wear an appropriate NIOSH/MSHA approved and properly fitted respirator during application and use of these products until vapors, mists and dusts are exhausted, unless air monitoring demonstrates vapors, mists and dusts are below applicable exposure limits. Follow respirator manufacturer's directions for respirator use.

The International Agency for Research on Cancer (IARC) reclassified styrene as Group 2B, "possibly carcinogenic to humans." This revised classification was not based on new health data relating to either humans or animals, but on a change in the IARC classification system. The Styrene Information and Research Center does not agree with the reclassification and published the following statement: Recently published studies tracing 50,000 workers exposed to high occupational levels of styrene over a period of 45 years showed no association between styrene and cancer, no increase in cancer among styrene workers (as opposed to the average among all workers), and no increase in mortality related to styrene.

Styrene is classified by OSHA and the Department of Transportation as a flammable liquid. Flammable products should be kept away from heat, sparks, and flame. Lighting and other electrical systems in the work place should be vapor-proof and protected from breakage.

Vapors from styrene may cause flash fire. Styrene vapors are heavier than air and may concentrate in the lower levels of molds and the work area. General clean air dilution or local exhaust ventilation should be provided in volume and pattern to keep vapors well below the lower explosion limit and all air contaminants (vapor, mists and dusts) below the current permissible exposure limits in the mixing, application, curing and repair areas.

Some products may contain additional hazardous ingredients. To determine the hazardous ingredients present, their applicable exposure limits and other safety information, read the Material Safety Data Sheet for each product (identified by product number) before using. If unavailable, these can be obtained, free of charge, from your CCP representative or from: CCP Composites US, P.O. Box 419389, Kansas City, MO 64141-6389; 816-391-6053.

FIRST AID: In case of eye contact, flush immediately with plenty of water for at least 15 minutes and get medical attention; for skin, wash thoroughly with soap and water. If affected by inhalation of vapors or spray mist, remove to fresh air. If swallowed, get medical attention.

Those products have at least two components that must be mixed before use. Any mixture of components will have hazards of all components. Before opening the packages read all warning labels. Observe all precautions.

Keep containers closed when not in use. In case of spillage, absorb with inert material and dispose of in accordance with applicable regulations. Emptied containers may retain hazardous residue. Do not cut, puncture or weld on or near these containers. Follow container label warnings until containers are thoroughly cleaned or destroyed.

**FOR INDUSTRIAL USE AND PROFESSIONAL APPLICATION ONLY. KEEP OUT OF REACH OF CHILDREN.**