Product Safety Assessment

**BETAMATE™ Epoxy Structural Adhesives**

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### Names
- BETAMATE™ epoxy structural adhesive
- BETAMATE™ crash-resistant epoxy structural adhesive
- BETAMATE™ toughened epoxy structural adhesives
- BETAFOAM™ structural foam insert (SFI – which includes a coating of BETAMATE adhesive)

### Product Overview
- BETAMATE™ epoxy structural adhesives are based on toughened epoxide chemistry. These adhesives are used in automotive manufacturing, making vehicles stiffer, safer, lighter, and more crash-resistant. BETAMATE epoxy structural adhesives are sold as colored pastes or as prefabricated BETAFOAM™ structural foam inserts (SFI). This family of products is manufactured by Dow Automotive, a business unit of The Dow Chemical Company. For further details, see Product Description.

- BETAMATE epoxy-based structural adhesive systems are used in automobile manufacturing during the early (body-in-white) stages of vehicle assembly. These adhesives are used in addition to welding and mechanical fasteners. BETAMATE epoxy structural adhesives are applied throughout the vehicle mainly to bond the parts of the car body, as well as flanges, rails, and other load-bearing parts, and to weld joints. They are also used in the aftermarket industry for vehicle repair. For further details, see Product Uses.

- Eye contact with uncured (wet) adhesives may cause irritation. Prolonged skin contact may cause irritation with local redness, but is unlikely to result in absorption of harmful amounts. Skin contact may cause an allergic reaction. At room temperature, exposure to vapor from these products is minimal. Inhaling vapors from heated material during product application may cause respiratory irritation. For further details, see Health Information.

- BETAMATE epoxy structural adhesives are for industrial use only. Worker exposure is possible in a manufacturing facility or at facilities using these adhesives. Exposure is minimized through engineering controls and the use of personal protective equipment. Consumers may operate a vehicle manufactured with these adhesives in fully cured form. For further details, see Exposure Potential.

- BETAMATE™ epoxy structural adhesives are thermally stable under recommended storage conditions. Exposure to elevated temperatures or heating can cause these materials to
decompose and release noxious fumes. These materials may be stored at temperatures less than 77°F (25°C) for up to 90 days. Store away from acids, amines, bases, and strong oxidizers such as nitric acid.\(^4\) For further details, see Physical Hazard Information.

**Manufacture of Product**

- **Capacity** – Dow Automotive manufactures BETAMATE™ epoxy structural adhesives at facilities in Michigan, USA; and Germany.
- **Process** – BETAMATE epoxy structural adhesives are formulated using proprietary Dow Automotive materials and technology.

**Product Description\(^2,6\)**

BETAMATE™ epoxy structural adhesives manufactured by Dow Automotive are one or two component, high-strength adhesives based on toughened epoxy chemistry. These adhesives improve a vehicle’s structural integrity, durability, and NVH performance (noise, vibration, and/or harshness). BETAMATE epoxy structural adhesives are capable of bonding coated or uncoated high-strength steel, aluminum, and magnesium, metals that have been traditionally difficult to weld. They are also used to bond carbon- and glass-fiber-reinforced composites and plastics. BETAMATE epoxy structural adhesives are formulated as colored pastes that are heated during application and applied either manually or robotically. The adhesives are cured (set) in an oven following application.

BETAFOAM™ structural foam inserts (SFI) consist of a foam core that is coated with a heat-activated, expandable BETAMATE epoxy adhesive coating. They are prefabricated to fit any cavity. These inserts improve vehicle structural safety, stiffness, and acoustics.

**Product Uses\(^1,2,3\)**

BETAMATE™ epoxy-based structural adhesives are used in automobile manufacturing during the early (body-in-white) stages of vehicle assembly. These high-strength adhesives are used in addition to traditional welding and mechanical fasteners. BETAMATE epoxy structural adhesives are applied throughout the vehicle interior and exterior. They are used without degreasing or priming. Specific applications include: mainly bonding of parts in the car body, such as hem flange bonding of doors, roofs, hoods, deck lids, and exterior closure panels. They are used to bond joints in engine compartments and roof panels, as well as rails and other load-bearing parts. They bond structural reinforcement parts directly to oiled metal. BETAMATE epoxy structural adhesives are also used in the aftermarket industry for vehicle repair.

BETAFOAM™ structural foam inserts are used to fill cowl bars, pillars, roof joints, rockers, and engine cradles. For more information and diagrams showing where these products are used in automobiles, see the following brochures:

- **BETAMATE Structural Adhesives: New-generation Structural Adhesives Increase Crash Resistance Without Adding Weight or Cost**
- **BETAMATE Structural Adhesives: Bond Headliners to Roofs and Improve NVH Performance**
- **BETAFOAM™ SFI Structural Foam Insert**

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Exposure Potential

BETAMATE™ epoxy structural adhesives are used in the production of vehicles and in the vehicle aftermarket industry. Based on the uses for these adhesives, the public could be exposed through:

- **Workplace exposure** – Exposure can occur in a BETAMATE epoxy structural adhesives manufacturing facility. Those working with these adhesives in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Worker exposure is also possible at automotive assembly plants or vehicle repair shops using these adhesives. Each facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit unnecessary exposure. See Health Information.

- **Consumer exposure to products containing BETAMATE epoxy structural adhesives** – Dow Automotive does not sell these adhesives for home use. Based on their widespread use in vehicle production, it is possible that consumers may operate a vehicle manufactured with them. By the time the vehicle reaches the consumer, the adhesive has fully cured (hardened) and exposure risks are very low. See Health Information.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil and surface or ground water. For small spills, BETAMATE epoxy structural adhesives should be absorbed with materials such as sand, sawdust, or cat litter. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, the material should be captured, collected, and reprocessed or disposed of according to applicable governmental requirements. See Environmental and Physical Hazard Information.

- **In case of fire** – Isolate the area and deny any unnecessary entry. Use a water fog or fine spray, carbon-dioxide or dry-chemical fire extinguishers, or foam. Use of a direct water stream may spread the fire. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet.

Health Information

- **Eye and skin contact** – Eye contact with these adhesives may cause irritation. Prolonged skin contact may cause irritation with local redness, but is unlikely to result in absorption of harmful amounts. Skin contact may cause an allergic skin reaction. These materials contain a component that has caused an allergic skin reaction in humans.

- **Inhalation** – At room temperature, exposure to vapor is minimal. Inhaling vapors from heated material during product application may cause respiratory irritation. These adhesives contain mineral and/or inorganic fillers. There is essentially no potential for inhalation of these fillers due to the physical state of these products.

- **Ingestion** – These materials have low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing large amounts may cause injury.

- **Repeated exposure** – In animals, components of these adhesives have caused adverse effects to the kidney and blood after repeated exposure.

For more information, see the relevant Safety Data Sheet.
Environmental Information

BETAMATE™ epoxy structural adhesives are blends of components. This is an overview of the environmental impact of major components. Specific product information is available on the Safety Data Sheet.

Propane, 2,2-bis[p-(2,3-epoxypropoxy)phenyl]-, polymers – The potential for this material to bioconcentrate (accumulate in the food chain) is moderate, and it is not considered readily biodegradable. It is moderately toxic to fish and other aquatic organisms on an acute basis (single exposure to a high concentration).

Polyurethane adduct P99-0151 – No bioconcentration is expected due to the relatively high molecular weight. This material is not biodegradable. High molecular weight polyurethanes are not expected to be acutely toxic to aquatic organisms.

1-Cyanoguanidine – This material cannot be considered readily biodegradable. It is not expected to accumulate in the food chain. 1-Cyanoguanidine is practically nontoxic to fish and other aquatic organisms on an acute basis (single exposure to high concentration).

Bisphenol A – This material is readily biodegradable and is not expected to accumulate in the food chain. Bisphenol A is moderately toxic to fish and other aquatic organisms on an acute basis. For more information on this material, see the Bisphenol A Product Safety Assessment.

Reaction product: bisphenol-A-(epichlorhydrin) epoxy resin (number average molecular weight <= 700) – This material is not biodegradable, and its potential to accumulate in the food chain is moderate. This material is moderately toxic to aquatic organisms on an acute basis. For more information on this material, see the Bisphenol A Diglycidyl Ether Product Safety Assessment.

Phenol, 4,4’-(1-methylethylidene)bis-, polymer with 2,2’-[(1-methylethylidene)bis(4,1-phenyleneoxy)methylene]bis[oxirane] (DGEBPA-based polymer) – This material not biodegradable. It is not expected to be acutely toxic to aquatic organisms, but may represent a choking hazard.

Wollastonite (8Cl) – This material is not expected to be toxic to aquatic organisms on an acute basis.

Polypropylene glycol diepoxide resin – This material is not readily biodegradable and is practically nontoxic to aquatic organisms on an acute basis.

For more information, see the relevant Safety Data Sheet.

Physical Hazard Information

BETAMATE™ epoxy structural adhesives are thermally stable under recommended storage conditions. Exposure to elevated temperatures or heating can cause these materials to decompose and release noxious fumes. Exposure to temperatures greater than 200°C (392°F) can cause these materials to decompose.

These products can be stored at temperatures less than 77°F (25°C) for up to 90 days. If “thawing” the adhesive is needed, do not apply heat to the container. Rather, let the container come to ambient temperatures 68–104°F (20–40°C) over the course of 3 days. Containers of epoxy adhesives, when improperly heated, can cause the epoxy to decompose and give off
noxious fumes. Hazardous polymerization resulting in heat and pressure build-up in closed containers could occur.

These epoxy adhesives are incompatible with acids, amines, bases, and strong oxidizing agents such as nitric acid. Some formulations are sensitive to air (oxygen). Store these materials indoors in a dry place, in tightly closed, properly vented containers, away from direct sunlight.

For more information, see the relevant Safety Data Sheet.

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Regulatory Information
Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of BETAMATE™ epoxy structural adhesives. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet or the Dow Customer Information Group.

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Additional Information
• Safety Data Sheet -- request using Contact Dow Automotive (http://automotive.dow.com/automotive/after/contact/index.htm)
• Contact Dow Automotive: (http://automotive.dow.com/automotive/after/contact/index.htm)
• Dow Customer Information Group (http://www.dow.com/assistance/dowcig.htm)
• BETAMATE™ Crash-Resistant Adhesives: Next-generation Structural Adhesives Increase Crash Resistance and Improve Cost and Weight Savings, Dow Automotive, Form No. 299-51241-207 HMC/GG, February 2007
• BETAMATE™ 1496V, Technical Data Sheet, Dow Automotive, Form No. 299-50255 (http://www.dow.com/PublishedLiterature/dh_0031/0901b80380031b1e.pdf?filepath=automotive/pdfs/noreg/299-50255.pdf&fromPage=GetDoc)

References

2 BETAFOAM™ SFI Structural Foam Insert, Dow Automotive, Form No. 299-50621-207 MHC/GG, page 1.
4 BETAMATE 1496V Material Safety Data Sheet, The Dow Chemical Company, ID No. 83430/0000
5 BETAMATE 1460US Epoxy Adhesive Material Safety Data Sheet, The Dow Chemical Company, ID No. 1002173/1001
7 BETAMATE 5103-2US Structural Adhesive Material Safety Data Sheet, The Dow Chemical Company, ID No. 51063/1001
8 BETAMATE 73345G Structural Adhesive Material Safety Data Sheet, The Dow Chemical Company, ID No. 51205/1001
9 BETAMATE 1460 US Fracture Toughened Epoxy Structural Adhesive, Dow Automotive, Form No. 299-50212, page 1.

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