

# Risk Assessment Safety Plan

## Project information:

|                             |               |  |
|-----------------------------|---------------|--|
| Polymer Infiltration Device |               | 03/01/18   |
| Name of Project             |               | Date of submission   |
| Team Member                 | Phone Number  | e-mail   |
| Mike Haimowitz              | (561)288-0323 | <a href="mailto:Mah13t@my.fsu.edu">Mah13t@my.fsu.edu</a>                       |
| James Jenkins               | (850)830-6623 | <a href="mailto:Jpj14b@my.fsu.edu">Jpj14b@my.fsu.edu</a>                       |
| Catherine Kent              | (850)212-2204 | <a href="mailto:Cak12b@my.fsu.edu">Cak12b@my.fsu.edu</a>                       |
| Emily Stern                 | (407)748-0304 | <a href="mailto:Ees14@my.fsu.edu">Ees14@my.fsu.edu</a>                         |
| Faculty mentor              | Phone Number  | e-mail   |
| Shayne McConomy             | (850)410-6624 | <a href="mailto:smcconomy@eng.famu.fsu.edu">smcconomy@eng.famu.fsu.edu</a>     |
| Chiang Shih                 | (850)410-6331 | <a href="mailto:shih@eng.fsu.edu">shih@eng.fsu.edu</a>                         |
| Eric Hellstrom              |               | <a href="mailto:hellstrom@asc.magnet.fsu.edu">hellstrom@asc.magnet.fsu.edu</a> |

## I. Project description:

A Polymer Infiltration Device is a device that will fill open cell lattice structures with silicone. Our device will use a vacuum pump in order to remove all the impregnated air in the silicone liquid. The liquid will be inside an evacuation chamber where it will be degassed. Then air will be permitted back into the chamber which will force the liquid silicone into a "jig". A jig is a chamber that holds the open cell lattice structure as the lattice is filled. Once the lattice is filled with silicone, and pressure is at equilibrium, the jig will be relinquished from the evacuation chamber, and set aside to cure over the course of 24 hours.

## II. Describe the steps for your project:

Receive Materials. Give materials to machine shop for assembly. Perform testing. Store extra Sylgard 184.

## III. Given that many accidents result from an unexpected reaction or event, go back through the steps of the project and imagine what could go wrong to make what seems to be a safe and well-regulated process turn into one that could result in an accident. (See examples)

The most major risk arises from the hydrogen gas that is slowly evolved over time during storage. From the Sylgard 184 Safety Data Sheet: "This product slowly evolved hydrogen on storage. Keep only in a vented container in a well ventilated area. Keep container closed and store away from water or moisture. Do not store in or use glass containers. Storage temperature: maximum 32 degrees Celsius." Main risks associated with Sylgard 184 arise from aerating it, and when it is burning. "In the case of a fire, Use AFFF alcohol compatible foam or water spray(fog). Most fire extinguishing media will cause hydrogen release. Thus, in poorly ventilated or confined spaces, the accumulation of hydrogen may result in flash fire or explosion if ignited. Applying foam may release flammable hydrogen gas that can be trapped under the foam." Unsuitable Extinguishing Media: "Dry powder. Do not allow extinguishing medium to contact container contents." Special protective equipment: "A self-contained respirator and protective clothing should be worn." Due to the Hydrogen gas, do not smoke around Sylgard 184.

## IV. Perform online research to identify any accidents that have occurred using your materials, equipment or process. State how you could avoid having this hazardous situation arise in your project.

All failure modes of device lead to non-catastrophic failure. Most risks are associated with the use of Sylgard 184. Sylgard 184 must be stored at below 32 degrees Celsius and in a vented container. Sylgard 184 produces Hydrogen when in storage due to the water vapor in the air. During storage, prevent contact with water, to mitigate hydrogen release. There is also risk associated with spilling the constituents. Spilled constituents produce very slippery surface. Very large spills should be contained by bunding and mopping/wiping/soaking up with absorbent material and placing in a vented container. Employ bunding in order to prevent spreading or entering into drains, ditches, or rivers, by using sand, earth, or other appropriate barriers.

**V. For each identified hazard or “what if” situation noted above, describe one or more measures that will be taken to mitigate the hazard. (See examples of engineering controls, administrative controls, special work practices and PPE).**

Sylgard 184 will be stored in a vented container to avoid Hydrogen gas buildup which could cause an explosion.  
 Never store Sylgard 184 in a high up place, this will increase risk of spillage.

**VI. Rewrite the project steps to include all safety measures taken for each step or combination of steps. Be specific (don't just state “be careful”).**

All risks associated with this device are due to hydrogen release of Sylgard 184 during storage and contact with the water vapor in the air.

**VII. Thinking about the accidents that have occurred or that you have identified as a risk, describe emergency response procedures to use.**

Call 911. Use proper fire control medium. Must use AFFF alcohol compatible foam or water spray (fog). If fire becomes too large to manage, evacuate or isolate the area according to your local emergency plan. Use water spray to keep fire exposed containers cool.

Spilled constituents produce very slippery surface. Very large spills should be contained by bunding and mopping/wiping/soaking up with absorbent material and placing in a vented container. Employ bunding in order to prevent spreading or entering into drains, ditches, or rivers, by using sand, earth, or other appropriate barriers.

**Sylgard 184 Material Handling and Safety information attached.**

**VIII. List emergency response contact information:**

- Call 911 for injuries, fires or other emergency situations
- Call your department representative to report a facility concern

| Name           | Phone Number  | Faculty or other COE emergency contact | Phone Number  |
|----------------|---------------|--|---------------|
| Mike Haimowitz | (561)288-0323 | Shayne McConomy                        | (850)410-6624 |
| Catherine Kent | (850)212-2204 | Donald Hollet                          |               |
| Emily Stern    | (407)748-0304 | Emmanuel Collins                       | (850)410-6331 |
|                |               | Eric Hellstrom                         |               |

**IX. Safety review signatures**

- Faculty Review update (required for project changes and as specified by faculty mentor)
- Updated safety reviews should occur for the following reasons:
  1. Faculty requires second review by this date:
  2. Faculty requires discussion and possibly a new safety review BEFORE proceeding with step(s)
  3. An accident or unexpected event has occurred (these must be reported to the faculty, who will decide if a new safety review should be performed.
  4. Changes have been made to the project.

| Team Member    | Date     | Faculty mentor | Date |
|----------------|----------|----------------|------|
| Mike Haimowitz | 03/01/18 |                |      |
| James Jenkins  | 03/01/18 |                |      |
| Catherine Kent | 03/01/18 |                |      |
| Emily Stern    | 03/01/18 |                |      |

**Report all accidents and near misses to faculty mentor.**

**SAFETY DATA SHEET**

According to article 31 and Annex II of the EU REACH Regulation

Version: 2.1

Revision Date: 01.08.2011

Superseded date: 01.08.2011

**SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)****1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY**

- 1.1 Product name** : SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)
- 1.2 Identified uses** : Vulcanising agents
- Uses advised against** : None known.
- 1.3 Company** : Dow Corning Europe S.A.  
rue Jules Bordet - Parc Industriel - Zone C  
B-7180 Seneffe  
Belgium
- E-mail address (Safety Data Sheet)** : sdse@dowcorning.com
- Customer Service** : English Tel: +49 611237507  
Deutsch Tel: +49 611237500  
Français Tel: +32 64511149  
Italiano Tel: +32 64511170  
Español Tel: +32 64511163
- Fax: +32 64888683
- 1.4 Emergency Phone Number** : Dow Corning (Barry U.K. 24h) Tel: +44 1446732350  
Dow Corning (Wiesbaden 24h) Tel: +49 61122158  
Dow Corning (Seneffe 24h) Tel: +32 64 888240

**2. HAZARDS IDENTIFICATION****2.1 Classification of the substance or mixture**

According to EU Directives 67/548/EEC or 1999/45/EC:

Not hazardous.

**2.2 Label elements****Labelling according to EEC Directive**

- S-phrases** : S9 Keep container in a well-ventilated place.  
S12 Do not keep the container sealed.  
S16 Keep away from sources of ignition - no smoking.

**2.3 Other hazards**

Some hydrogen gas may be released. Hydrogen is flammable and can form explosive mixtures with air.

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Version: 2.1

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## SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)

### 3. COMPOSITION / INFORMATION ON INGREDIENTS

**Chemical characterization:** Silicone resin solution.

**According to EU Directives 67/548/EEC or 1999/45/EC:**

| Name                                       | CAS-No.    | EINECS/<br>ELINCS<br>No. | REACH<br>Registration<br>Number | Conc.<br>(% w/w) | Classification                                      |
|--|------------|--------------------------|---------------------------------|------------------|---|
| Dimethylvinylated and Trimethylated Silica | 68988-89-6 | Exempt or not available  | -                               | 12.0             | Substance with a Community workplace exposure limit |

**According to Regulation (EC) No. 1272/2008:**

| Name                                       | CAS-No.    | EINECS/<br>ELINCS<br>No. | REACH<br>Registration<br>Number | Conc.<br>(% w/w) | Classification                                      |
|--|------------|--------------------------|---------------------------------|------------------|---|
| Dimethylvinylated and Trimethylated Silica | 68988-89-6 | Exempt or not available  | -                               | 12.0             | Substance with a Community workplace exposure limit |

CLP classifications are based on all current available data including from known international organizations. These classifications are subject to revision as more information becomes available.

### 4. FIRST AID MEASURES

#### 4.1 Description of First Aid Measures:

- On contact with eyes** : No first aid should be needed.
- On skin contact** : No first aid should be needed.
- If inhaled** : No first aid should be needed.
- On ingestion** : No first aid should be needed.

### 5. FIRE-FIGHTING MEASURES

- 5.1 Suitable extinguishing media** : On large fires use AFFF alcohol compatible foam or water spray (fog). On small fires use AFFF alcohol compatible foam, CO<sub>2</sub> or water spray (fog). Water can be used to cool fire exposed containers. Most fire extinguishing media will cause hydrogen release. Thus, in poorly ventilated or confined spaces, the accumulation of hydrogen may result in flash fire or explosion if ignited. Applying foam may release flammable hydrogen gas that can be trapped under the foam.
- Unsuitable extinguishing media** : Dry powder. Do not allow extinguishing medium to contact container contents.
- 5.2 Hazards during fire fighting** : None known.

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**SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)**

**Hazardous Combustion Products** : Thermal breakdown of this product during fire or very high heat conditions may evolve the following decomposition products: Silica. Carbon oxides and traces of incompletely burned carbon compounds. Formaldehyde. Hydrogen.

**5.3 Special protective equipment/procedures** : A self-contained respirator and protective clothing should be worn. Determine the need to evacuate or isolate the area according to your local emergency plan. Use water spray to keep fire exposed containers cool.

**6. ACCIDENTAL RELEASE MEASURES**

**6.1 Personal precautions, protective equipment and emergency procedures** : Wear proper protective equipment.

**6.2 Environmental precautions** : Prevent from spreading or entering into drains, ditches or rivers by using sand, earth or other appropriate barriers.

**6.3 Methods and materials for containment and cleaning up** : Determine the need to evacuate or isolate the area according to your local emergency plan. Very large spills should be contained by bunding, etc... procedures. Mop, wipe or soak up with absorbent material and place in a vented container. The spilled product produces an extremely slippery surface.

**7. HANDLING AND STORAGE**

**7.1 Advice on safe handling** : Avoid eye contact. Do not breathe spray or mist. General ventilation is required. Do not empty into drains.

**7.2 Advice on storage** : This product slowly evolves hydrogen on storage. Keep only in a vented container in a well ventilated area. Keep container closed and store away from water or moisture. Do not store in or use glass containers.  
Storage temperature: maximum 32 °C

**7.3 Specific uses** : Refer to technical data sheet available on request.

**8. EXPOSURE CONTROLS / PERSONAL PROTECTION**

**8.1 Control parameters**

| Name                                       | CAS-No.    | Exposure Limits  |
|--|------------|--|
| Dimethylvinylated and Trimethylated Silica | 68988-89-6 | 4 mg/m3 TWA Respirable dust<br>10 mg/m3 TWA Inhalable dust |

**8.2 Exposure controls**

**Engineering Controls** : Ventilation : Refer to Section 7.1

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**SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)****Personal protection equipment**

- Respiratory protection** : A suitable respirator must be worn if the product is used in any circumstances where an aerosol or mist may be generated, such as during spraying or similar activities. Depending on the working conditions, wear a respiratory mask with filter(s) P or use a self-contained respirator. The choice of a filter type depends on the amount and type of chemical being handled in the workplace. Regarding filter characteristics, contact your respiratory protection supplier.
- Hand protection** : Gloves are not normally required.
- Eye/face protection** : Safety glasses should be worn.
- Skin protection** : Protective equipment is not normally necessary.
- Hygiene measures** : Exercise good industrial hygiene practice. Wash after handling, especially before eating, drinking or smoking.
- Additional information** : These precautions are for room temperature handling. Use at elevated temperature or aerosol/spray applications may require added precautions. For further information regarding the use of silicones / organic oils in consumer aerosol applications, please refer to the guidance document regarding the use of these types of materials in consumer aerosol applications that has been developed by the silicone industry ([www.SEHSC.com](http://www.SEHSC.com)) or contact the Dow Corning customer service group.
- Environmental exposure controls** : Refer to section 6 and 12.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

- Form** : Liquid
- Colour** : Colorless
- Odour** : Very little
- Boiling point/range** : > 100 °C
- Flash point** : > 101.1 °C (Closed Cup)
- Explosive properties** : No  
Some hydrogen gas may be released. Hydrogen is flammable and can form explosive mixtures with air.
- Specific Gravity** : 1.03
- Viscosity** : 110 cSt at 25°C.

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**SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)****Oxidizing properties** : No

The above information is not intended for use in preparing product specifications. Contact Dow Corning before writing specifications.

**10. STABILITY AND REACTIVITY**

- 10.1 Reactivity** : Hydrogen is liberated on contact with water, alcohols, acidic or basic materials, many metals or metallic compounds and can form explosive mixtures in air.
- 10.2 Stability** : Stable under normal usage conditions.
- 10.3 Possibility of hazardous reactions** : Some hydrogen gas may be released. Hydrogen is flammable and can form explosive mixtures with air.
- 10.4 Conditions to avoid** : None established.
- 10.5 Materials to avoid** : Can react with strong oxidising agents.
- 10.6 Hazardous decomposition products** : Thermal breakdown of this product during fire or very high heat conditions may evolve the following decomposition products: Silica. Carbon oxides and traces of incompletely burned carbon compounds. Formaldehyde. Hydrogen.

**11. TOXICOLOGICAL INFORMATION****Acute toxicity:**

- On contact with eyes** : May cause temporary discomfort.
- On skin contact** : No adverse effects are normally expected.
- If inhaled** : No adverse effects are normally expected.
- On ingestion** : No adverse effects are normally expected.

**Chronic toxicity:**

- On skin contact** : No adverse effects are normally expected.
- If inhaled** : No adverse effects are normally expected.
- On ingestion** : No adverse effects are normally expected.

**Toxicokinetics, metabolism and distribution** : No specific information is available.

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**Other Health Hazard Information** : This product contains (a) powder(s) hazardous by inhalation. This is not relevant to the current physical form of the product, which is not in a respirable form. Product may emit formaldehyde vapour at temperatures above 180°C in the presence of air. Formaldehyde vapour is a suspected carcinogen, toxic by inhalation and irritating to eyes and the respiratory system. Exposure limits should be strictly respected.

<sup>1</sup> Based on product test data.

<sup>2</sup> Based on test data from similar products.

**12. ECOLOGICAL INFORMATION****12.1 Ecotoxicity effects**

No adverse effects on aquatic organisms.

**12.2 Persistence and degradability**

Siloxanes are removed from water by sedimentation or binding to sewage sludge. In soil, siloxanes are degraded.

**12.3 Bioaccumulation**

No bioaccumulation potential.

**12.4 Release to waters / Mobility in soil****Fate and effects in waste water treatment plants:**

Removed > 90% by binding onto sewage sludge. No adverse effects on bacteria. The siloxanes in this product do not contribute to the BOD.

**13. DISPOSAL CONSIDERATIONS**

**Product and packaging disposal** : Dispose of in accordance with local regulations. According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user, preferably in discussion with the waste disposal authorities.

**14. TRANSPORT INFORMATION****Road / Rail (ADR/RID)**

Not subject to ADR/RID.

**Sea transport (IMDG)**

Not subject to IMDG code.



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**SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)****Air transport (IATA)**

Not subject to IATA regulations.

**Remarks** : VENTED PACKAGES ARE FORBIDDEN FOR AIR TRANSPORT.**15. REGULATORY INFORMATION****15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture****Status****AICS** : All ingredients listed, exempt or notified.**DSL** : All ingredients listed or exempt.**IECSC** : All ingredients listed or exempt.**EINECS** : All ingredients listed, exempt or notified (ELINCS).**ENCS/ISHL** : All ingredients listed, exempt or notified.**KECL** : All ingredients listed, exempt or notified.**PICCS** : All ingredients listed, exempt or notified.**TSCA** : All chemical substances in this material are included on or exempted from listing on the TSCA Inventory of Chemical Substances.

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**SYLGARD(R) 184 SILICONE ELASTOMER CURING AGENT (CURING AGENT information is below)****16. OTHER INFORMATION**

This product safety data sheet was prepared in compliance with article 31 and Annex II of the EU REACH Regulation as well as its relevant amendments, on the approximation of laws, regulations and administrative provisions relative to the classification, packaging and labelling of dangerous substances and preparations.

It is the responsibility of persons in receipt of this Product Safety Data Sheet to ensure that the information contained herein is properly read and understood by all people who may use, handle, dispose or in any way come in contact with the product. If the recipient subsequently produces a formulation containing the Dow Corning product, it is the recipient's sole responsibility to ensure the transfer of all relevant information from the Dow Corning Product Safety Data Sheet to their own Product Safety Data Sheet in compliance with article 31 and Annex II of the EU REACH Regulation.

All information and instructions provided in this Safety Data Sheet (SDS) are based on the current state of scientific and technical knowledge at the date indicated on the present SDS. Dow Corning shall not be held responsible for any defect in the product covered by this SDS, should the existence of such defect not be detectable considering the current state of scientific and technical knowledge.

As stated above, this Safety Data Sheet has been prepared in compliance with applicable European law. If you purchase this material outside Europe, where compliance laws may differ, you should receive from your local Dow Corning supplier a SDS applicable to the country in which the product is sold and intended to be used. Please note that the appearance and content of the SDS may vary - even for the same product - between different countries, reflecting the different compliance requirements. Should you have any question, please refer to your local Dow Corning supplier.

Source of information: Internal data and publically available information