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Product Stewardship Summary

CAS: various
Formula: various

Organometallics

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Introduction

Organometallic compounds are among modern chemistry's most powerful tools. They are used to create powerful drugs to treat serious diseases, and they allow us to make the strong, flexible plastics and rubber in everything from toys and automobiles to packaging, electronics and medical equipment.

As is often the case in chemistry, the same characteristics that give organometallics their power also make them difficult to manufacture, store and handle. Many react rapidly with air and water, and some of them do so violently. Albemarle uses sophisticated containers and has established extensive systems and procedures which, when followed, allow for the safe transportation and handling of these valuable compounds.



Description and Properties

Organometallics are a class of chemical compounds containing one or more metal atoms bonded directly to one or more carbon atoms. The term also is used to describe compounds with similar structures that are formed with carbon and semi-metals such as silicon or arsenic.

Most organometallics are highly reactive and many have catalytic properties; that is, they influence the speed and characteristics of certain chemical reactions. Organometallics vary widely in their appearance and properties depending

on the elements they contain, from clear liquids to opaque solids. Their toxicity also varies. Some are classified as skin irritants while others can cause severe thermal burns.

Uses

Many modern drugs wouldn't be possible without the control organometallics provide over the complex reactions in which they are made. Organometallics also are essential tools in production of many plastics and synthetic rubber, where they increase the speed and efficiency of the production process and help fine-tune the characteristics of the material.

The many products made in processes using organometallics include packaging for food and medicines, fabrics, electrical insulation, plumbing pipe, countless toys and even artificial

hip joints. They're used to make water purification products, and they allow us to make inexpensive polyethylene milk bottles that are lighter and stronger. Auto and truck tires perform better and last longer thanks to synthetic rubber made with organometallic catalysts. The same is true of the belts and hoses under the hood of your car and your fuel tank, as well as the wiper blades that keep your windshield clear of rain and snow.

Health Information

Organometallics range in toxicity from irritants to poisons and because some react readily with water and air, they can cause thermal burns to the eyes, skin, respiratory tract, and gastrointestinal tract. When burned, organometallics give off toxic gases and fumes that can cause severe injury or death. Inhalation can

irritate the throat and lungs, and can cause headaches, fever and breathing difficulties. If ingested, organometallic compounds can cause damage to the central nervous system, loss of coordination and coma.

Exposure Potential

A great deal of effort has been devoted to preventing exposure to organometallics.

Plant workers receive special training and wear fireproof full-body suits, goggles and gloves when unloading the products, which are transported in special, high-strength containers



designed to prevent the contents from escaping. A number of these containers have survived train wrecks and other serious incidents without leakage.



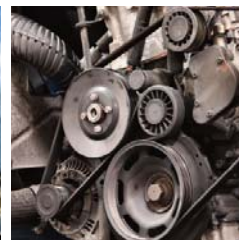
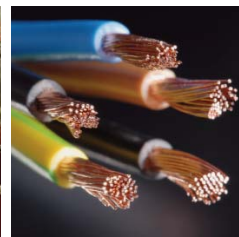
shipped and handled in solution with flammable solvents, discharges may also produce a flammable vapor cloud.

Organometallics tend to break down rapidly in the atmosphere and therefore are unlikely to accumulate significantly in the environment.

Physical Hazards

Some organometallics burst into flame when exposed to air and can react explosively with water. Although solvent solutions containing organometallics are less reactive, these should be considered equally hazardous because they can form clouds of flammable vapor and enough heat to trigger an explosion or fire. These flammable vapors are heavier than air and may travel to a source of ignition and flash back.

Organometallics may also react with polyesters and certain natural fibers, including cotton. For all of these reasons, organometallics must always be transported in approved containers and handled only by trained, properly equipped personnel.



Environmental Information

Those organometallics that ignite on contact with air or water can produce considerable heat and dense smoke, along with carbon dioxide, water and various metal oxides that depend on the nature of the organometallic compound. Incomplete combustion can also produce carbon monoxide and acidic byproducts. Because some organometallics are

Derivation/Manufacturing

Many types of organometallic compounds can be manufactured with each of the metals in the periodic table of the elements, and these compounds are manufactured worldwide using many different methods and chemical processes.

Albemarle's organometallics production

facility in Pasadena, Texas, is the world's largest. Albemarle also produces these compounds in Orangeburg, South Carolina; Baton Rouge, Louisiana; Feluy, Belgium; and Osaka, Japan. The Osaka facility is a joint venture with Mitsui Chemicals.

Regulatory Information

Some organometallics are classified for shipping purposes by the US Department of Transportation and the International Maritime Organization as spontaneously combustible liquids, and various dilute organometallic solutions are classified as water-reactive, flammable liquids. Use and disposal are regulated under authority of the US Toxic Substances Control Act (TSCA), which is enforced by the US Environmental Protection Agency.

International shipments of organometallics are regulated under the United Nations Transport of Dangerous Goods Code. Various international agreements in Europe regulate rail and road shipment.

The Occupational Safety and Health Administration governs US workplace-safety issues involving organometallics according to exposure limits published by the National Institute for Occupational Safety and Health (NIOSH). Workplace monitoring must be conducted to ensure that workers are not overexposed to organometallic compounds for which exposure limits have been established.

Product Stewardship

Albemarle is committed to manage manufacturing and handling so that organometallic products can be transported and used safely, and every Albemarle Corporation employee involved

in the manufacture, distribution and sale of these products shares responsibility for proper stewardship.

We minimize risks of leakage, personnel exposure and environmental impact by specifying appropriate containers, procedures and protective equipment, and by recommending procedures for proper disposal.

Albemarle publishes and monitors a 24-hour emergency response number, along with an incident-reporting and corrective-actions program for transit incidents. We produce and supply training materials for organizations that handle organometallics, and we require transportation firms to meet strict safety standards. Safety drills are conducted periodically to test and validate our emergency response mechanisms and to make certain that we are properly prepared for incidents involving organometallics.

Prior to selling organometallics to any potential customer, we assess the entire distribution chain and transportation route from loading through use of the product, and we repeat this process periodically thereafter with each customer as described in the American Chemistry Council's Responsible Care Security Code.

Previous customer experience and their intended use are reviewed and, depending on the results, an on-site evaluation may be conducted in which Albemarle will interview the firm's management and employees, review their documentation and inspect their

facilities. The process covers industrial hygiene, safety, environmental considerations, process and transportation equipment, unloading procedures, return of empty containers, emergency preparedness, record-keeping and regulatory compliance.

Albemarle provides detailed guidance in proper handling and storage, as well as emergency response procedures, and we foster open relationships in which we encourage our customers to report problems and actively participate in audits of their systems and procedures.

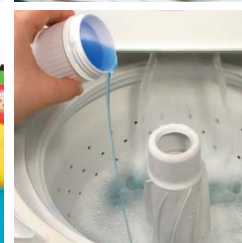
Conclusion

It is difficult to imagine life without the many thousands of products produced using organometallic compounds, and it is easy to take for granted all those medicines and plastics and paints and

fabrics unless we're involved in their production. These remarkable chemicals contribute to our lives in countless ways, yet most of us know little or nothing about them.

In fact, the benefits of organometallics

go beyond the many things we make with them. Modern chemical plants and transportation systems are safer because of the systems and equipment developed to work with these powerful chemical tools. With continued careful product stewardship and thoughtful regulation as well as research, organometallics will continue to make our lives healthier, more comfortable and safer worldwide.



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Albemarle Corporation is a member of the American Chemistry Council and, through ACC's participation with the International Council of Chemical Associations (ICCA), has prepared this document to improve product stewardship within the chemical industry and with suppliers and customers.

This document provides general information about organometallic compounds and does not supplant or replace required regulatory and/or legal communication documents, nor is it intended to provide an in-depth discussion of health and safety information. Always consult the product's material safety data sheet, product label and technical data sheet before using the chemical.