

PG Semester – IV

Elective course – 1b: Physical Chemistry Special

Unit – V (A): Corrosion (contd.)

Loss of valuable products:

No particular concern is attached to slight leakage of sulfuric acid to the drain, because it is a cheap commodity. However, loss of a material worth several dollars per gallon requires prompt corrective action. Slight losses of uranium compounds or solutions are hazardous and can be very costly. In such cases, utilization of more expensive design and better materials of construction are well warranted.

Effects on safety and reliability:

The handling of hazardous materials such as toxic gases, hydrofluoric acid, concentrated sulfuric and nitric acids, explosive and flammable materials, radioactive substances, and chemicals at high temperatures and pressures demands the use of construction materials that minimize corrosion failures. Stress corrosion of a metal wall separating the fuel and oxidizer in a missile could cause premature mixing, which could result in a loss of millions of dollars and in personal injury. Failure of a small component or control may result in failure or destruction of the entire structure. Corroding equipment can cause some fairly harmless compounds to become explosive. Economizing on materials of construction is not desirable if safety is risked.

Other health considerations are also important such as contamination of potable water. Corrosion products could make sanitizing of equipment more difficult. An interesting example here involves milk and other dairy product plants. The straight chromium stainless steels are satisfactory in old plants where much of the equipment is disassembled and sanitized by "dishpan" techniques. Newer plants use in-place cleaning and sanitizing which require more

corrosive chemicals, particularly with regard to chloride ions and pitting. These solutions are circulated through the system without taking it apart thus saving many labor hours. These advances require use of more pit-resistant stainless steels, such as type 316 containing nickel and molybdenum.

Corrosion also plays an important part in medical metals used for hip joints, screws, plates, and heart valves. Reliability is, of course, of paramount importance here.

Product liability:

There is an important and disturbing trend in this country toward putting the blame and legal responsibility on the producers or manufacturer of any item or piece of equipment that fails because of corrosion or for any other reason. The U.S. Department of Commerce has issued a report on the increase of product liability claims that points out that such claims have far outstripped inflation and are approaching medical malpractice insurance claims. One estimate indicates an average loss in 1965 from a product liability claim was \$11,644. By 1973 this figure was \$79,940, an increase of 686 percent. Lack of "contract," or "negligence," is no longer a defense.

A ridiculous example (to make the point) would be blaming the auto manufacturer if your car corroded because you drove it through a lake of hydrochloric acid! The car could be made of tantalum, but the cost would be astronomical, nobody would buy it, and then a disclaimer would have to be filed stating that hydrofluoric acid must not be present!

What this all means is that the manufacturer or producer of a product must make sure that it is made of proper materials, under good quality control, to a design that is as safe as possible, and the inspection must be critical. The corrosion engineer must be doubly sure that failure will not occur in the actual environment and should also be aware of the legal liability aspects. Passage of time is not a precluding factor; lawsuits resulted from failure of a bridge that had been in use for about 40 years.