PG Semester – IV

Elective course – 1b: Physical Chemistry Special

Unit – V (A): Corrosion (contd.)

Maintenance and operating costs:

Substantial savings can be obtained in many types of plants through the use of corrosion-resistant materials of construction. One example is classic in this respect. A chemical plant effected an annual saving of more than $10,000 merely by changing the bolt material on some equipment from one alloy to another more resistant to the conditions involved. The cost of this change was negligible. In another case a waste acid recovery plant operated in the red for several months until a serious corrosion problem was solved. This plant was built to take care of an important waste disposal problem. Application of cathodic protection can cut leak rates in existing underground pipelines to practically nil with attendant large savings in repair costs. Maintenance costs are scrutinized because the labor picture accents the necessity for low-cost operation.

Close cooperation between the corrosion engineer and process and design personnel before a plant is built can eliminate or substantially reduce maintenance costs in many cases. Slight changes in the process sometimes reduce the corrosiveness of plant liquors without affecting the process itself, thus permitting the use of less expensive materials. These changes can often be made after the plant is in operation, but original preventive measures are more desirable. Corrosion difficulties can often be "designed out" of equipment, and the time to do this is in the original design of the plant.

Plant Shutdowns: Frequently plants are shut down or portions of a process stopped because of unexpected corrosion failures. Sometimes these shutdowns are caused by corrosion involving no change in process conditions, but occasionally they are caused by changes in

operating procedures erroneously regarded as incapable of increasing the severity of the corrosive conditions. It is surprising how often some minor change in process or the addition of a new ingredient changes corrosion characteristic completely. The production of a chemical compound vital to national defense is an example. To increase its production, the temperature of the cooling medium in a heat-exchanger system was lowered and the time required per batch decreased. Lowering the temperature of the cooling medium resulted, however, in more severe thermal gradients across the metal wall. They, in turn, induced higher stresses in the metal. Stress corrosion cracking of the vessels occurred quickly, and the plant was shut down with production delayed for some time.

Corrosion monitoring of a plant process is helpful in preventing unexpected corrosion failure and plant shutdown. This can be done by periodically examining corrosion specimens that are continually exposed to the process or by using a corrosion probe that continuously records the corrosion rate. Periodic inspection of equipment during scheduled downtimes can help prevent unexpected shutdown.

Contamination of product:

In many cases the market value of the product is directly related to its purity and quality. Freedom from contamination is a vital factor in the manufacture and handling of transparent plastics, pigments, foods, drugs, and semiconductors. In some cases a very small amount of corrosion, which introduces certain metal ions into the solution, may cause catalytic decomposition of a product, for example, in the manu- facture and transporting of concentrated hydrogen peroxide or hydrazine.

Life of the equipment is not generally an important factor in cases where contamination or degradation of product is concerned. Ordinary steel may last many years, but more expensive material is used because the presence of rust is undesirable from the product standpoint.