Factors influencing corrosion :

① Nature of metals

② Nature of corroding environment

Nature of metals

1) Purity of metal : Impurity of a metal causes heterogeneity and form minute cells and the anodic part gets corroded. The rate and extent of corrosion increases with extent of impurities.

E.g. Zinc metal containing impurity such as Pb or Fe undergoes corrosion.

% Purity	99.999	99.99	99.95	99.0
Corrosion rate	1	2,650	5,000	7,200

2) Physical state of the metal: Physical state of metal means orientation of crystals, grain size, stress etc. The larger the grain-size of metal/alloy, the smaller will be its solubility and hence, lesser will be its corrosion. Areas under stress, tend to

be anodic and corrosion takes place at that stressed area. E.g. Caustic embrittlement takes place in stressed parts such as bends, joints in boilers.

3) Nature of oxide film: When metals are exposed to atmosphere, practically all metals get covered with a thin surface film of metal oxide. The ratio of the volume of metal oxide to the metal is known as specific volume ratio. Greater the specific volume ratio, lesser is the oxidation corrosion rate. E.g. The specific volume ratio of Ni, Cr and W are 1.6, 2.0 and 3.6 respectively. Consequently the rate of oxidation corrosion is least for tungsten (W).

4) Position in Galvanic series: The metal higher up in galvanic series, greater is its tendency

to become anodic and hence greater is the rate of corrosion. When two metals are in electrical contact, greater is the difference in their positions in the galvanic series, faster is the corrosion of anodic metal.

(5) Relative areas of the anode and cathode:

The rate of corrosion of metal is less when the area of the cathode is smaller. When cathodic area is smaller, the demand for electrons will be less and this results in the decreased rate of dissolution of metal at anodic regions:

$$\text{Rate of corrosion of anodic region} \propto \frac{\text{Cathodic area}}{\text{Anodic area}}$$

Example: A small steel pipe fitted in a larger Cu tank undergo localized, rapid and severe corrosion.

(6) Solubility of corrosion products: If the corrosion product is soluble in the corroding

medium, then corrosion proceeds at a faster rate otherwise if it is insoluble, corrosion will be suppressed. E.g: $PbSO_4$ formation in case of Pb in H_2SO_4. Here, by the formation of insoluble $PbSO_4$, corrosion proceeds at a smaller rate.

(7) Volatility of corrosion products: Ex calcite (rapid and continuous) corrosion of metal takes place if corrosion product is volatile. This is due to the fact that as soon as corrosion product is formed, it volatizes, thereby leaving the underlying metal surface for further attack. E.g. Mo forms MoO_2 volatile oxide.

(8) Galvanic: When a metal, which occupies a higher position in galvanic series is placed in H_2SO_4, it undergoes corrosion forming a film and hydrogen gas.

E.g. Corrosion of zinc rod dipped in H_2SO_4 is very slow, because of high over Voltage (0.70V). However, if few drops of copper sulphate ($CuSO_4$) are added, the corrosion rate of zinc is accelerated, because some copper gets deposited on the zinc forming minute cathodes, where the hydrogen over Voltage is only 0.33V. Thus, reduction in over Voltage of the corroding metal/alloy accelerates the corrosion rate. Metals for which over Voltages are more get corroded slowly, where as those which have low over Voltages, the rate of corrosion is high.

Nature of corroding environment

1) Temperature: The rate of corrosion increases with rise in temperature. This is due to the fact that the anodic attack by the anions, the cathodic evolution of hydrogen gas and solubility of O_2

decreases with rise of temperature.

2] pH : Acidic media are more corrosive than alkaline and neutral media. However, metals like Al, Pb etc. are corroded in alkaline medium.

3] Humidity: The greater is the humidity, the greater is the rate and extent of corrosion, because the moisture acts as medium for O_2 in air and behaves as an electrolyte.

4] Conductance: As the conductivity of the corrosion medium increases, the corrosion rate also increases. Higher the conductivity of the medium, faster the ions can migrate between the anodic and cathodic regions of the corrosion cell, in turn, faster will be the exchange of electrons at the electrode surfaces. This facilitates higher ~~corrosion~~ corrosion rate.

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pH: * Metals do not undergo corrosion at pH greater than 10. This is due to the formation of protective coating of hydrous oxides of iron

* Between pH 10 and 3, the presence of oxygen is essential for corrosion.

* If the pH is less than 3, corrosion occurs even in the absence of oxygen.