INVESTIGATION OF CORROSION AND WEATHERING PHENOMENA IN TROPICAL MARINE ENVIRONMENT

By: K.P. Störmer*

The adverse effects of tropical climate and sea water on almost all kinds of materials are the cause of huge capital losses inflicted to the national income apart from physical dangers occuring from weathering and especially corrosion effects on machinery and structures. Suitable, economical protection against weathering can only be found out in long-term tests.

Three weathering and two Meteorological stations have been set up by the Mechanical Engineering Department, Materials Technology Laboratory in order to perform natural weathering tests. Four programs are presently carried out for local paint, steel and aluminium producing companies. A fourth year project on standardization of weathering programs and an investigation of corrosion stimulator deposition on different defined surfaces in tropical marine atmosphere are presently being undertaken.

Measurements of meteorological and chemical data of a test site are chosen on the basis of obtaining information about the effects of important combinations of these parameters on corrosion. Long-term average values of temperatures, humidity or precipitation measured and published according to standard methods tell very little about corrosiveness of the particular atmosphere since such data do not take into consideration the physical and chemical relationships between climatic effects and atmospheric phenomena. Atmospheric corrosion of metals progress only in periods when there is a surface electrolyte present and the rate of corrosion during such periods is related to the corrosion activity of the surface electrolyte and the nature of the metal. The meteorological measurements of immediate surrounding of the test station should therefore indicate the duration of presence of surface water. The measuring instruments normally used to identify the amount of precipitation are not sufficiently sensitive to measure the vanishingly small quantities of precipitation which are significant in atmospheric corrosion. They do not detect the uniform coverage with dew on surfaces in weather which is free of precipitation The duration of surface wetting is determined directly by a specially designed corrosion macrocell. In order to find parameters characterizing the test site in chemical terms, measurements of air pollutants and/or corrosion stimulators are carried out.

First results of investigations on mechanisms of acceleration of corrosion processes by gaseous or water-soluble solid atmospheric constituents show that the highest or lowest absolute amount of these stimulators in the air does not have marked effect on the corrosion progress. There rather seems to be a connection between the progress of corrosion and the total amount of these species coming into contact with a special geometric surface. The concentration of stimulators is therefore determined and expressed in terms of weight per unit area per unit time.

The following parameters are going to be investigated over a period of three years:

1. The influence of the surface geometry/structure on stimulator deposition, in in this case chloride ions in marine atmosphere.
2. The influence of the exposure position/inclination of the test panels on the deposition amount.
3. Isolation of relevant meteorological data of the immediate surrounding of the test site.
4. Investigation of seasonal patterns.

The results of the research program will be published by the end of 1979

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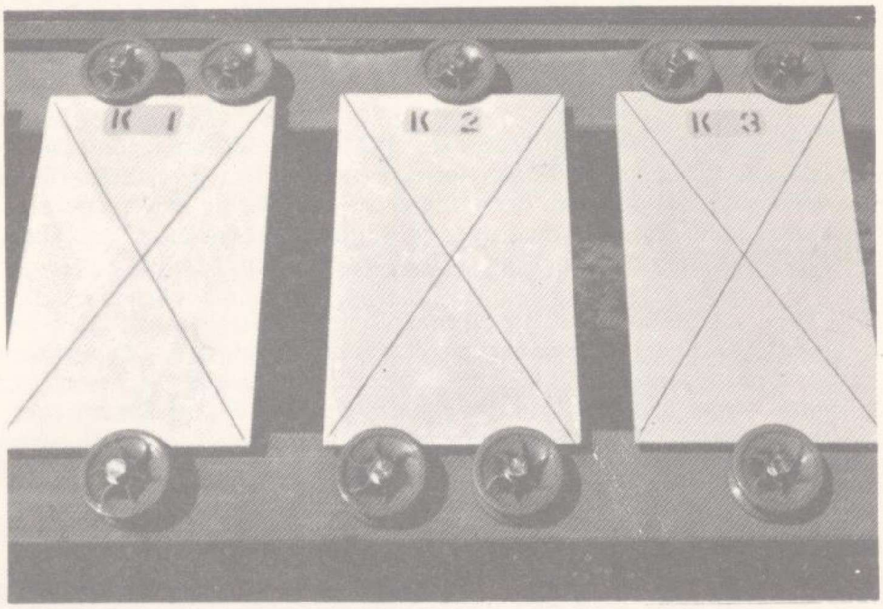
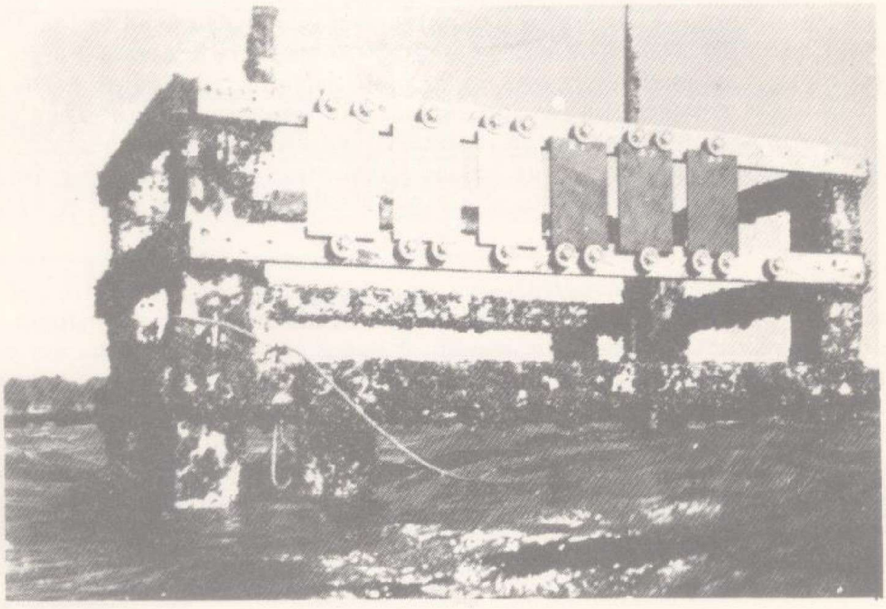


Steel panels coated with different paint systems exposed to marine atmosphere (clamping illustrated)



The corrosion station in the sea (Msasani Bay)

Corrosion rack for specimen exposure in marine climate and recording unit for time-of-wetness measurements

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