An in-situ Atmospheric Corrosion Sensor

Rintaro Minamitani
Mechanical Engineering Research Laboratory,
Hitachi, Ltd.
502 Kandatsu, Tsuchiura, 300-0013, Japan
E-mail: minami@merl.hitachi.co.jp

As most of today's electronic equipment contains metal, and the metal parts may corrode when corrosive gases exist around them, the corrosion level of metal parts is an important gauge for designing effective countermeasures and ensuring the equipment's reliability.

We have developed an in-situ atmospheric corrosion sensor (ACS) for measuring the corrosion level of metal in an environment in which electronic equipment is operated. After only one month of exposure to the environment, the ACS enables the approximate thickness of the corrosion layer on the metal surface to be measured without any professional knowledge.

The ACS consists of several silver films of different known thickness (i.e., from 25 to 150 nm), mounted on a transparent glass plate, as shown in Fig. 1. The silver films corrode when exposed to corrosive gases such as H_2S or SO_2. Under such conditions, the corrosion product Ag_2S forms on each film's exposed surface and proceeds down through the film towards the glass plate, i.e., it does not form from the glass side. All the films corrode by the same amount after one month. Because of the different thicknesses of the films, the thinner silver films corrode through the full thickness (top three films in Fig. 2), while the thicker silver films corrode partially (bottom two films in Fig. 2). In the former case, the sulfide (Ag_2S) color can be seen from the glass side; however, in the latter case, the non-corroded metal color remains i.e., the corrosion cannot be seen since the film has not yet corroded all the way through. Accordingly the ACS indicates that the degree of corrosion thickness is between the thickness of the thickest fully corroded film and that of the partially corroded film next to it i.e., thickness between the film 3 and 4.

We used the ACS to investigate the corrosiveness of the environment in an ironworks control room containing electronic equipment. This investigation showed that the current conditions in the control room make an unacceptable environment for electronic equipment. It is thus concluded that to improve the environment, the control room may need to be fitted with a filtering system.

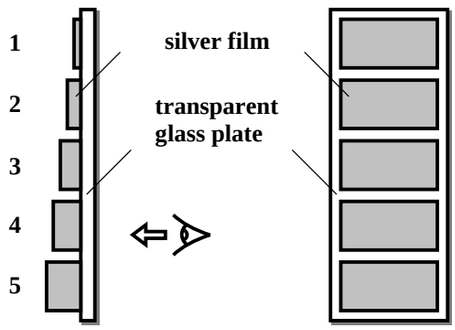

Fig. 1. Schematic of the ACS.

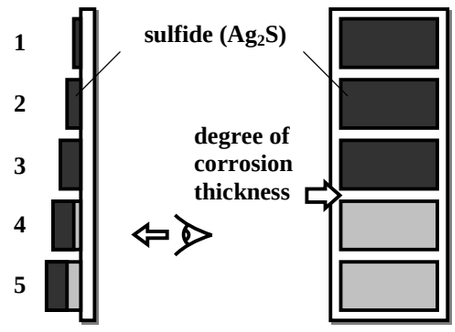

Fig. 2. Schematic of the structure of the ACS exposed to a testing environment for a certain period.