Bimetallic corrosion in atmospheres

The electrolyte in atmospheric environments consists of a thin condensed film of moisture containing any soluble contaminants in the atmosphere such as acid fumes, chlorides etc. The formation of this film depends mainly on three important variables:

- Temperature
- relative humidity
- the presence of dust particles in the atmosphere.

The characteristics of a moisture film on a surface are not necessarily the same as those of a bulk electrolyte. In a moisture film, the replenishment of dissolved oxygen is much greater than in bulk electrolyte, owing to the large ratio of surface area to electrolyte volume. Under conditions of lowered relative humidity, which permits rapid evaporation, convective mixing in the condensed layer further hastens the arrival of dissolved oxygen at the cathode. Both characteristics of the moisture film can result in an increase in galvanic corrosion rate.

Secondly, the electrolyte conductivity of the condensed layer parallel to the surface of the metal is low compared with that of the bulk electrolyte, even when it contains acid fumes or chlorides. This high electrolytic resistance of the thin condensed electrolytic layer has a controlling effect on the distribution of the corrosion. The galvanic attack will normally be highly localised and is rarely found much further than 25 mm from the bimetallic junction.5 The geometrical anode/cathode area ratio, which for a galvanic couple is an important factor in the observed corrosion rate, is of limited influence. The controlling effect of the electrolytic resistance is equally applicable to anode and cathode of the bimetallic couple. In general, it can be stated that in atmospheric bimetallic corrosion the active areas are small and approximately equal, regardless of the geometrical area ratios.