

**Initiation and propagation of filiform corrosion on coated aluminium alloys:
In-situ FTIR micro-spectroscopy investigations.**

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Filiform corrosion is an active corrosion cell that moves across the metal surface underneath the coating, leaving a tail filled with corrosion products¹⁻³. Filiform corrosion is a main problem on coated aluminium alloys exposed to a humid atmosphere. The corrosion is generally initiated in defects in the coating and propagates in presence of aggressive ions (chloride, sulphate...), oxygen and sufficient relative humidity. The filament can be divided into a head and a tail, the head acting as an electrochemical cell. It has been shown that the head contained an acidic salt layer of aluminium chloride and its hydrolysis products, while the tail was filled with carbonate containing aluminium hydroxyde.⁴

The initiation and the propagation of filiform corrosion on coated aluminium alloy AA6016 were investigated using an experimental set-up for *in-situ* infrared reflection absorption spectroscopy. It consisted of an *in-situ* cell, where samples were exposed to controlled humid conditions, and an optical microscope linked with a Fourier Transformed Spectrometer.

The first stages of filiform corrosion were investigated by recording infrared spectra as a function of exposure in humid conditions. It was shown that the initiation started with the formation of a pit in the scratch close to the organic coating. With the formation of aluminium chloride and its hydrolysis products in the pit, the local conditions were aggressive enough to weaken the adhesion of the coating and initiate the formation of filament.

Monitoring of the propagation of filiform corrosion was also performed *in-situ* through a thin transparent organic coating, as a function of relative humidity. Infrared spectra were recorded through the coating in the filament head. With the presence of $\text{Al}(\text{H}_2\text{O})_6^{3+}$ in the anodic head, a characteristic absorption band at 2500 cm^{-1} due to the stretching vibrations of water in octahedral configuration, was visible in a range where the organic coating was transparent, and served as an indicator for monitoring the propagation of filiform corrosion.

References

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