

Corrosion in Braking Systems: Effect of Corrosive Environments

the latter being detected in traces only. As a qualitative consideration, the crystallinity degree of the three oxy-hydroxides can be defined as moderate in agreement with the full width at half maximum of the measured diffraction peaks.

2) In the case of salt spray exposure (5% NaCl), a completely different phase distribution is revealed, with the akaganeite polymorph being the most abundant phase, while lepidocrocite and goethite are present only in traces. At a deeper level the crystallinity degree of the akaganeite phase appears as particularly low and, thus, associated with broad diffraction peaks. In agreement with the literature, the presence of β -FeOOH can be considered as a marker of an aggressive corrosion process that briefly leads to the formation of highly oxidized iron-based species, such as magnetite and/or maghemite.

Conclusions

This article demonstrates that the corrosion of FMs included in a braking system can lead to a wide range of different corrosion scales, mainly depending on the nature of the aggressive environment at which they have been exposed. Characterization of the obtained corrosion products plays a major role in a) clarifying the corrosion-based failure mechanism; and b) proposing effective solutions to extend the corrosion resistance of future braking systems.

A clear correlation between the nature of the corrosive agents and the composition and structure of the obtained corroded FMs is elucidated using a multi-technique approach. It is demonstrated that the exposure of the FM to a 100% RH atmosphere leads to a diffused presence of small goethite and lepidocrocite crystallites on its surface. On the contrary, exposure to a salt spray solution is responsible for the presence of akaganeite domains with very low crystallinity degree. Finally, the exposure to sulfuric acid vapors induces the formation of hydrated iron sulfate-based products in correspondence of metallic fibers comprised in the FM.

Taken altogether it can be concluded that a) corrosion products present on the

surface of the considered FM are always associated with iron oxidation; b) corrosion by-products are strongly linked with each investigated corrosive environment; and c) corrosion scales can be identified by a coupled evaluation of their spatial distribution, composition, and morphology.

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