

THE CONSEQUENCES OF THE PRESENCE OF URBAN ATMOSPHERICAL PARTICLES AND AIRBORNE IN CorTen® STEEL SURFACES.

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CorTen steel is known because it develops a layer composed by iron oxides which protects the surface against the corrosion. The presence of different atmospheric particles and urban-marine airborne in that surface can affect the normal development of the protective rust layer that generates this kind of steel. In an urban-marine atmosphere there are many different particles such as silicates and carbonates and airborne such as NaCl, nitrates, etc. These compounds can change the nature and the composition of the rust layer affecting to the protective properties of this surface. As a consequence, unusual iron oxide phases are formed.

In the present work, several CorTen steel surfaces have been analyzed. These surfaces are exposed in Bilbao (North of Spain) to the same urban-marine atmosphere. For this study, non-destructive techniques like Raman spectroscopy and SEM-EDS (Scanning Electron Microscope coupled to Energy-Dispersive X-ray spectroscopy) have been used. With these techniques, we have been able to observe the changes of the evolution in the rust layer due to the presence of particles and airborne.

It has been detected the presence of akaganeite (β -FeOOH). Akaganeite appears in those environments with high amount of salt airborne [1]. This iron oxyhydroxide has a very porous structure and facilitates the entrance of ions and contaminants in the internal side of the structure [2]. It has been checked also that the massive presence of silicates in the steel surface can delay the passivation of the rust layer. In fact, the presence of this kind of compounds avoids the transformation of the lepidocrocite (γ -FeOOH, active phase) into goethite (α -FeOOH, stable phase) [3]. In addition, the acid gases present in the urban atmosphere affect the steel surface. For example, it has been detected gypsum in all sculptures. This gypsum can be formed by the reaction of calcite particles with SO_2 present in the atmosphere [4]. This reaction can also provide the enough SO_4^{2-} ions to generate iron sulphates with the iron present in the steel. Furthermore, iron nitrates were also identified. Iron nitrates can be formed due to the massive presence of NO_x gases that attack the steel surface.

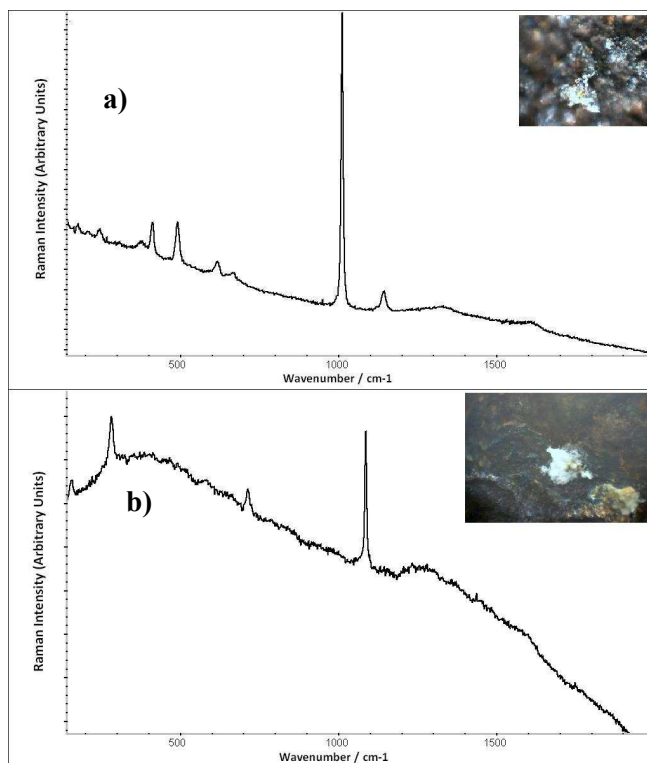


Figure 1. Raman spectra of a) gypsum and b) calcite particles found in the same CorTen steel surface.

References

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