Comparative study of steel corrosion characterization by visible and THz imaging techniques

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Transport infrastructures play a significant role in the economy of countries. However, in European countries, transport infrastructures aging (>40 years) and traffic increase require to develop in-situ efficient inspection and maintenance solutions. Monitoring of steel and composite structures are important issues for sustainability of existing and new infrastructure. Classical approach relies on large human activities eventually performed in unsafe conditions. To overcome the problem on site contactless global automated measurement methods are to be favoured.

For apparent corrosion, visible imaging coupled with image processing allows to detect and characterize the extension of the defective area. Anyway, characterization of corrosion thickness and nature require complementary measurements. Among imaging techniques, knowing that corrosion acts as a insulating layer, active infrared thermography is a possible approach [1-2]. But here we will focus on the complementary approach based on THz-TDS imaging as investigated and tested for corrosion detection under painting with preliminary corrosion type classification [2].

In the present study, we first performed a measurement campaign on several steel samples at different corrosion stages. Typically, three stages were investigated: from non-corroded with paint coating, to pitting corrosion up to fully corroded sample surface.

Data were gathered by means of the Z-Omega Fiber-Coupled Terahertz Time Domain (FICO) system working in a high-speed reflection mode and were processed by using a properly designed data processing chain recently proposed in [3] and involving a noise filtering procedure based on the Singular Value Decomposition (SVD) of the data matrix. Complementary post-processing approach for quick detection and characterization were added to these filtered data.

The obtained results, which will be presented in detail at the conference, allowed us to state the imaging capabilities offered by the adopted instrumentation and obtain valuable information on the surveyed specimens, such as the corrosion thickness connection with apparent pseudo-intensity images. Finally, perspectives on coupling techniques will be introduced.

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References


