1.9.3. COMPUTED TOMOGRAPHY – A NEW TOOL STUDYING HIDDEN CORROSION

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The progress in Computed Tomography (CT) applied for dimensional control, which has been reached in the last years [1], has opened new fields in materials characterization. Especially volume properties can be non-destructively and quantitatively analysed which are non-accessible by other methods. These possibilities are used to study time dependent properties of corrosion.

As an example concrete cylinders with embedded steel bars are investigated. The used experimental set-up, the procedure to evaluate the volume of the working electrode before and after different times of corrosion from the CT data are described and analysed.

Along with the investigations by CT electrochemical methods were used to monitor corrosion of steel in concrete. Therefore the galvanostatic pulse measurement was applied to describe the continuously corrosion process on the surface of the embedded steel cylinders. Moreover the mass loss of the embedded steel cylinders was postulated from the electrochemical data using Faraday's law. Finally the results of the electrochemical studies and the results from the CT data were correlated to give a prognosis of the corrosion progress. In addition the differentiation between total and pitting corrosion is essential for the corrosion progress and first shown in these investigations non-destructive by CT.

An estimation of the detection limits of damaged areas was performed using the CT simulation program aRTist [2]. With the same parameters as used at the real measurements an embedded steel bar electrode was simulated with different sizes of cylindrical, conical and spherical corroded pits. The different simulations are performed under the assumption that the corroded volumes are empty or filled with corrosion products with reduced density compared to the basis material of the electrode.

References:

1. **Bartscher M.** at al., Enhancement and Proof of Accuracy of Industrial Computed Tomography Measurements // CIRP Annals-Manufacturing Technology. – 2007. – Vol. 56. – Issue 1. – P. 495 – 498.

2. **'aRTist'** analytical Radiographic Testing inspection simulation tool, developed at BAM.