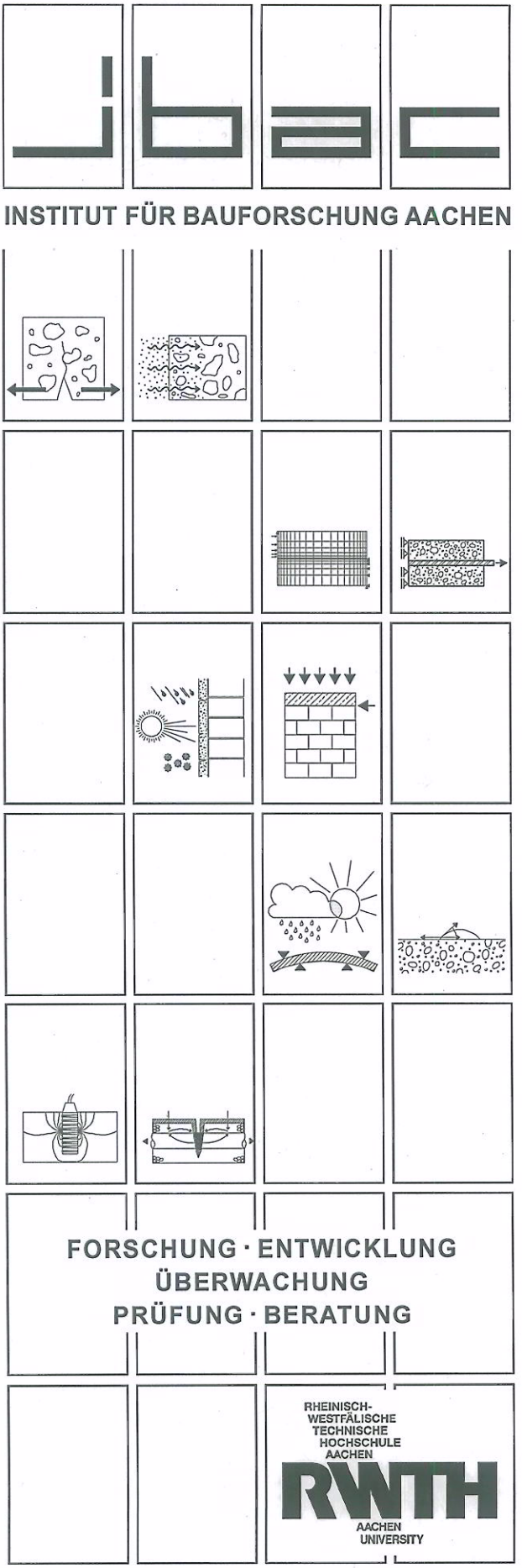

Test Report
M 1281/3

Corrosion Behaviour of Reinforcement in Contact with Dryflex I and Dryflex II

RWTH RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN

ibac INSTITUT FÜR BAUFORSCHUNG AACHEN

Ha/Rei/Fk/Sc
1. Ausfertigung

SUBJECT

Corrosion Behaviour of Reinforcement in Contact with Dryflex I and Dryflex II

Test Report No.

M 1281/3/3
vom 16.12.2011

Development of Subject

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Contract Date/Order Confirmation 02.02.2009
Order Date 02.12.2011
Reference -

Dieser Bericht umfasst 6 Seiten, davon 4 Textseiten.

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1 GENERAL

This report deals with the corrosion behaviour of reinforcement in contact with Dryflex I and Dryflex II. Drytech S.A. assures, that this products are identical to those tested in M 1281/1 /4/. In the following Dryflex I equates to System C2 and Dryflex II equates System C4. The results presented below are taken from M 1281/1 /4/.

On January 21st, 2009 Drytech S.A. entrusted the Institute of Building Materials Research Aachen (ibac) with corrosion tests on reinforcement steel in contact with two acrylate gel systems called System C2 and C4 in the following. The aim of the corrosion tests is to quantify corrosion protection properties of the used gel systems in contact with steel reinforcement.

2 TEST PROCEDURES

2.1 General

In the course of the test program three different kinds of electrochemical corrosion test procedures were performed. A test on so called "cracked specimens", "gravel pocket specimens" and "chloride specimens". The mentioned set-ups where developed in order to simulate typical boundary conditions for the use of acrylate gels in concrete structures. The interim report no. M 1281/1 /4/ focuses on the "cracked specimen" set-up. More background information about the development of the test set-ups to be used within this measurement campaign can be found in /1/. The tests presented in this report were performed as potentiostatic corrosion tests using a three electrode set-up.

The injection of the acrylate gel was done by representatives of Drytech S.A. on January, 21st, 2009. After completion of the injection all test specimens where covered with wet cloths for 24 hours in a climate of 23 °C and 50 % relative humidity. After that all specimens were mounted into the test set-ups. As a next step the free corrosion potentials of the working electrodes (embedded steel bars) were measured until a stabilization could be stated. This test was conducted after another 24 hours. After another 24 hours the potentiostatic test procedure was started with an anodic polarization rate of 100 mV/day until a total anodic polarization of 500 mV against the free corrosion potential of the working electrode.

Macro cell current measurements were conducted every two hours. Assuming that the whole steel surface in contact with acrylate gel is likely to corrode the measured corrosion currents were transformed into surface related current densities.

In the following the used test set-ups are described briefly.

2.2 Potentiostatic corrosion tests on "cracked specimens"

When cracks are sealed by means of acrylate gels steel bars crossing those cracks will be surrounded by a thin layer of this material. This matter of fact is simulated by using so called "cracked specimens" shown in Figure 1. Up to the time of injection the specimens were stored under submerged conditions at 23 °C for at least 28 days.

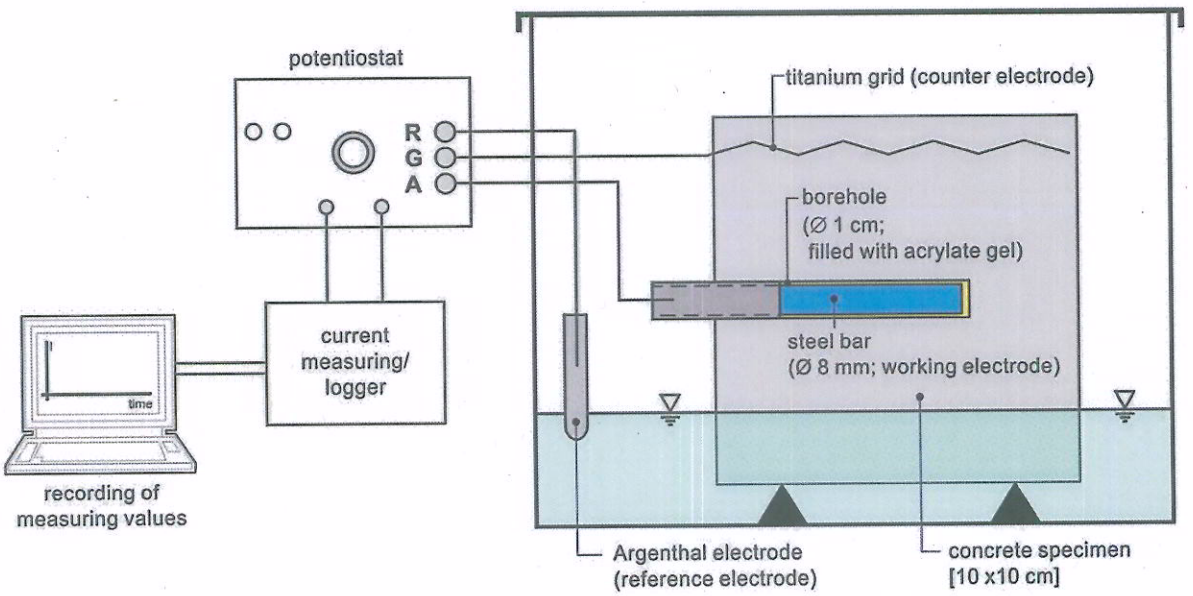

Fig. 1: Schematic test set-up for the "cracked specimens"

For each gel type (C2, C4) two specimens were tested in the shown manner.

3 RESULTS

3.1 Corrosion tests on "cracked specimens"

The measured current densities of a period of about 100 days are presented in Figures B1 and B2, Page B1. The initial current densities with values about 10 µA/cm² quickly decrease

for test specimens C2_R1, C4_R1 and C4_R2. After 20 days no macro cell corrosion activity can be measured for these specimens. Specimen C2_R1 even shows cathodic currents after 1 day which is why the curve cannot be displayed in diagram B1 (black curve). This effect may be linked to the migration of alkaline components of the pore solution of the concrete. Just specimen C2_R2 constantly shows very low macro cell currents in the range of 0,04 µA/cm². Given the fact that the whole surface is corroding evenly this means that we deal with a mean loss of bar radius of about 0,45 µm/a according to Faraday's law. Current densities below 0,01 µA/cm² are related to a passive steel bar in concrete, see /2/. The tests will be continued until the end of may 2009. After dismounting the electrodes in June 2009 the visual inspection of specimen C2_R2 will show, if a general corrosion attack or a localized one (pitting) is present.

in standing for the
Head of the Institute
by order

Dipl.-Ing. K. Reichling

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RHEINISCH-WESTFÄLISCHE TECHN. HOCHSCHULE AACHEN

in standing for the
Official in charge
by order

Dipl.-Ing. C. Helm

LITERATURE

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Table A1: Concrete mix for the „cracked specimens“

Cement type	Cement content	Mix proportions 1 : γ : ω	Aggregate
-	kg/m³	-	-
1	2	3	4
CEM I 32,5 R	450	1 : 3,0 : 0,5	CEN sand according to DIN EN 196-1: 2005-05

Table A2: Concrete mix for the „gravel pocket specimens“

Cement type	Cement content	Mix proportions 1 : γ : ω	Grading curve
-	kg/m³	-	-
1	2	3	4
CEM I 32,5 R	300	1 : 6,0 : 0,6	AB 16

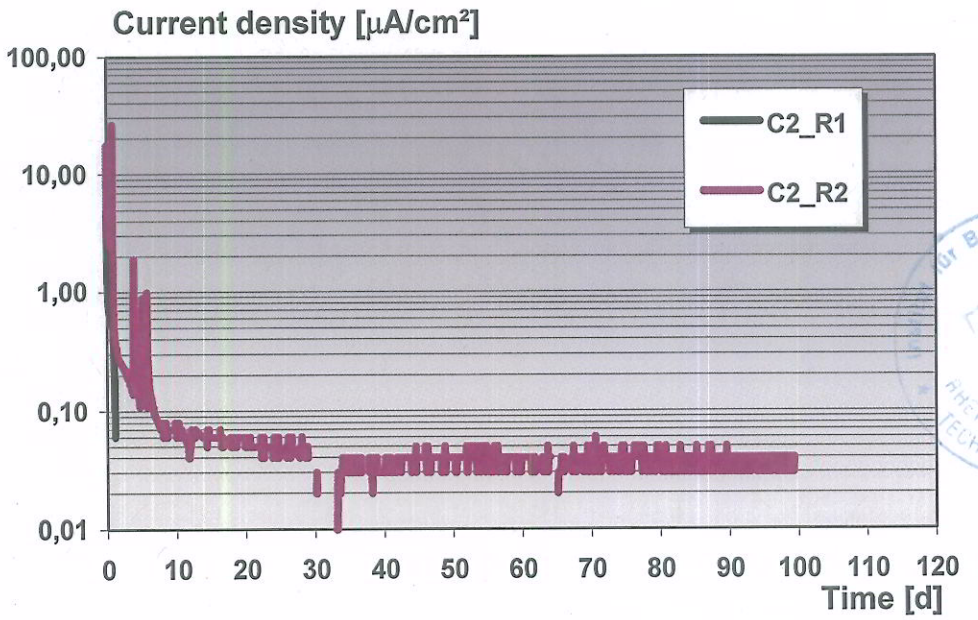

Fig. B1: Current densities of potentiostatic tests on "cracked specimens" series Gel C2

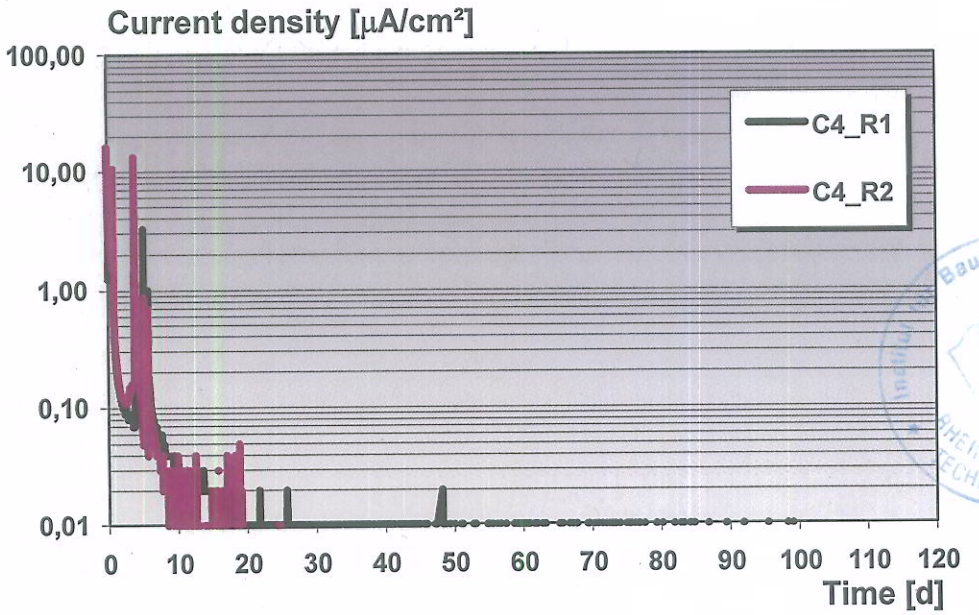

Fig. B2: Current densities of potentiostatic tests on "cracked specimens" series Gel C4