

Application Note

NDT of debonds in GFRP pipe couplers



FI Test- und Messtechnik
GmbH

Microwave testing becomes more and more important as an NDT method concerning electrically non-conducting material. Glass fiber reinforced plastic (GFRP) is a typical example of this class of material.

This application note describes the detection of debonds in an adhesively bonded connection between two pipe ends and a coupler. A circumferential PTFE film on one of the pipe ends is used to artificially model a debond of kissing bond type, see figure 1.

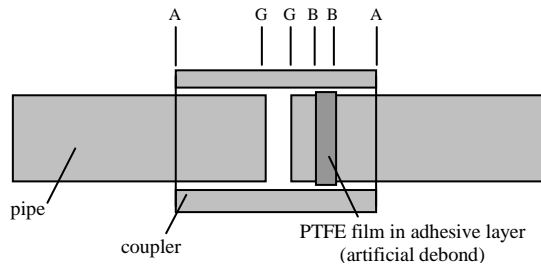


Figure 1: Principle of coupler with artificial debond

The pipe ends were of 6" inner diameter with a wall thickness of about 3 mm. The coupler length was 220 mm, its thickness was about 8 mm. Figure 2

shows a photograph of the circumferential debond before bonding.



Figure 2: Photograph of one pipe end with artificial debond

The test setup is shown in figure 3. The microwave system FMH1 of FI Test- und Messtechnik GmbH was used, fixed in a scanning system. The probe was placed about 1 to 2mm above the coupler surface. Scanning was performed primarily in axial direction with additional rotational increments. The raw data are postprocessed by using a special software which allows the user to look specifically for different kinds of defects. Two of such evaluations are shown in the following

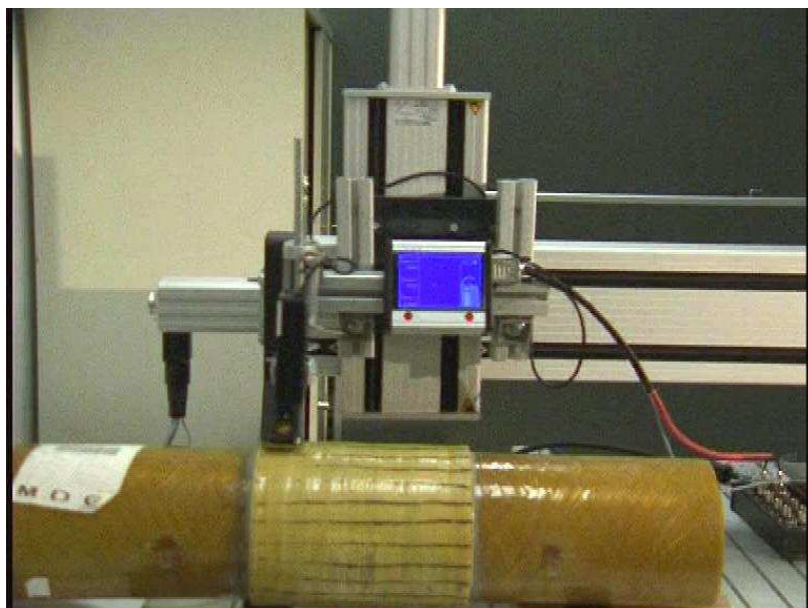


Figure 3: Test set up for microwave inspection of the bonded coupler

Figure 4 shows the C-scan along the cylindrical area in a plane view: the circumferential coordinate as the vertical coordinate extending from 0° to 360° and the axial coordinate horizontally extending over 270 mm. The letters A and B mark the ends of the coupler and the ends of the debond, respectively. The broad white vertical line between B and B clearly gives an image of the debond.

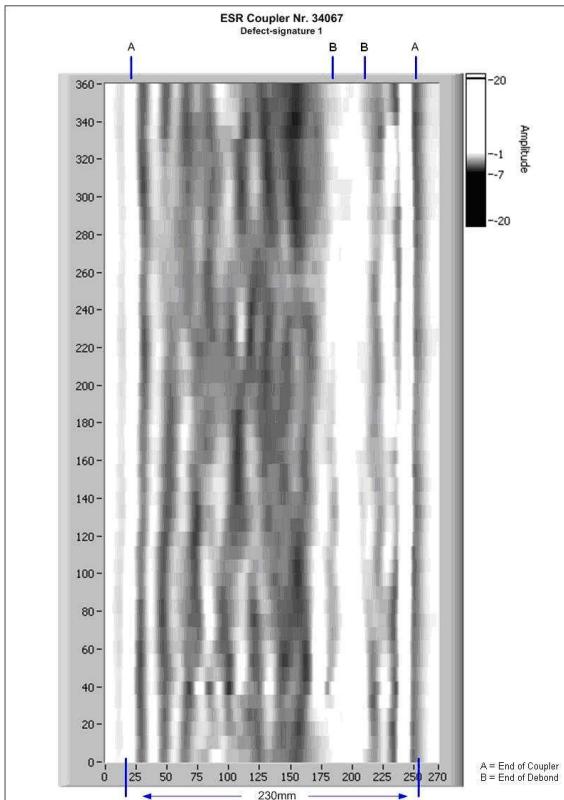


Figure 4: C-scan of coupler area. Postprocessing optimized for debond recognition

Figure 5 is based on the same raw data, but the postprocessing is adjusted to optimum gap recognition. This gap extends between both letters G and can clearly be recognized. The dark vertical line in the middle of the gap is caused by a circumferential bulge of the adhesive which was verified by visual and tactile inspection.

Figure 4 and Figure 5 are only two typical examples of a series of tests on adhesively bonded GFRP pipe couplers.

We want to thank Richard Lee from ESR Technology Ltd. for providing the test samples.

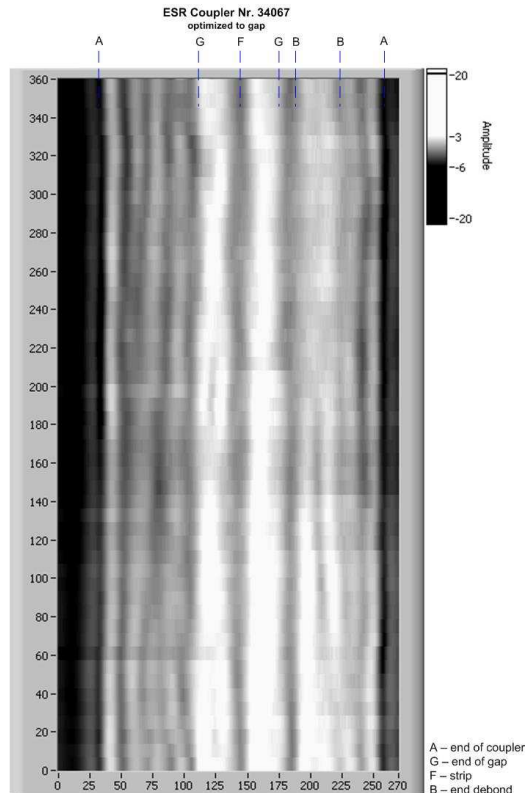


Figure 5: C-scan of coupler area. Postprocessing optimized for gap recognition

If you would like to know more about microwave testing please do not hesitate to contact us.

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