

Minutes of the third project team meeting:

Participants:

AGFW e.V.

Besier, Rolf

Bayer MaterialScience AG:

Homann, Dr. Malte

Centro Sviluppo Materiali S.p.A.:

Bufalini, Andrea

Gaz de France Suez

Benamar, Aicha

Salzgitter Mannesmann Forschung GmbH:

Flügge, Dr. Wilko; Hilgert, Dr. Oliver; Orth, Dr. Thomas, Zimmermann, Dr. Steffen

Salzgitter Mannesmann Line Pipe GmbH:

Brauer, Dr. Holger

Sika Danmark A/S:

Andersen, Kenneth; Rasmussen, Lou V.

Sika Services AG:

Burchardt, Dr. Bernd

Stepanski Engineering (on behalf of University of Paderborn):

Stepanski, Dr. Horst

LWF - University of Paderborn, coordinator:

Boeddeker, Tobias; Schmale, Hans Christian

Agenda:

TOP 1: Welcome and acceptance of the minutes of the last meeting

TOP 2: Research results of project partners

TOP 3: Next steps

TOP 4: Coordination

TOP 5: Tour of Centro Sviluppo Materiali

TOP 6: Miscellaneous & end of the meeting

TOP 1: Welcome and acceptance of the minutes of the last meeting

Mr. Bufalini introduces the meeting and welcomes the participants.

Mr. Boeddeker welcomes the participants and introduces the agenda. The minutes of the meeting held on 25th June 2008 in Hamm were accepted by all partners without reservations.

As the mandate for signature for signing the confidentiality agreement with Bayer MaterialScience from Gaz de France Suez is still outstanding, Mr. Boeddeker asks the participants, if Mr. Homann is allowed to attend the meeting or not. Additionally Mr. Boeddeker asks the representative of Gaz de France Suez, if the mandate will be signed. Mrs. Benamar answered that Gaz de France Suez will sign the mandate. The project group decides that Mr. Homann is allowed to attend the meeting.

Mr. Boeddeker explains the circumstances of withdrawal of Bohlen & Doyen of the project team and the consequences for the project.

In spite of the fact that lots of aims are already achieved, some working points are in delay. These working points are: optimisation of joint design (permanent procedure), adhesive development, development of repair procedure and quality control system. The transfer to field conditions delays due to withdrawal auf Bohlen & Doyen.

TOP 2: Research results of the project partners

Mr. Boeddeker presents the research results of the LWF. Tests were performed using small scale pipe specimens to determine the strength of pipes using different fixation devices. It has to be determined, if these fixation devices can even transmit forces occurring while pipe laying in the field.

Concerning filling of the gap it is interesting for non destructive testing, where defects like air bubbles emerge. Mr. Boeddeker will check this and provide the information to SZMF. Mr. Burchardt states that adhesives with low viscosity filled in with low pressures will lead to good gap fillings.

Afterwards, Mr. Boeddeker presents results of tensile tests on small scale pipe specimens bonded with PU154, PU155 and PU156. Displacements measured and displayed in graphs are global values. In the future, strains of the specimens should be measured using extensometers. Interesting for calculation purposes is only the elastic region of the specimen's force-displacement curves.

Results displayed by Mr. Boeddeker concerning a sleeve made of PE are not promising. Mr. Homann proposes to use CFRP as another material for the sleeve.

Tests to determine the surface energies and the resulting bond strength of coated pipes were performed at the LWF. Finding a correlation between surface energies, wetting and resulting bond strength, failed. Wetting is a necessary, but not sufficient characteristic to get maximum bond strength. Due to promising results of strength tests using coated pipes, it was decided to perform following tests with coatings as well. Mr. Burchardt will check for a 2K-primer on epoxy bases for this purpose. Mr. Homann hints that using a primer, adhesion and behaviour under corrosion can be enhanced. Mr. Burchardt adds that using a primer, a weak boundary layer can be

avoided. Tests with accelerated cured PU156 show an increased strength of bulk specimens but decreased strength of bonded pipes because of decreased strains. Mr. Burchardt states that this has to be prevented by modifying future adhesives. Gaz de France Suez will provide detailed information about costs and times for welding to get indication how fast adhesives have to be cured to be able to compete with standard joining technologies.

It was decided to use a sealing to divide the adhesives and the conducted medium in the pipes. Mr. Burchardt proposes to use butyl rubber as a sealing material.

Because a new adhesive is not available, yet, future tests will be done using PU156. It was stated that development of procedures is very important and that a focus has to be set on evaluating the methods developed.

Mr. Burchardt hints to repeat determination of mechanical properties of shrinking material to get indication of the creeping behaviour of this material.

Tests with lateral misaligned pipes show that variations of diameter of bonded pipes can be neglected. To proof this thesis, Gaz de France Suez recommends performing tests with pipes with a defined ovality.

Mr. Andersen presents tests made with modifications of PU156 on tensile specimens and simple overlapped tensile specimens. It could be shown that adhesives with sufficient strength and strains can be produced. In addition, a cohesive appearance of fracture can be realised on steel surfaces.

Mr. Fluegge presents results of experiments made with PU156 on simple overlapped specimens. Focus was on defects while applying the adhesives. As defects, changes in surface treatments were realised. Additionally the influence of kissing bonds on the strength of adhesively bonded specimens could be shown.

After that Mr. Fluegge presents results of tests done with contaminated adhesives. As contaminations, scale was used. This leads to increased tensile forces and displacements. Mr. Burchardt explains that scale is a filler and therefore responsible for the increased mechanical properties. Oil as a contamination in the adhesive leads to decreased mechanical properties and to nearly complete adhesive appearance of fracture. It could be shown that imperfections as trapped air in the adhesive layer and the position of these imperfections affect the mechanical properties. Bonding the specimens in two stages to simulate a repair concept leads to promising results. It has to be stated that position of injection holes has big influences on a good formation of the adhesive layer. Humidity has to be avoided due to rapidly decreased mechanical properties on wet surfaces.

Mr. Orth explains the results achieved in developing a non destructive quality control system. For this aim, specimens with different, defined defects were tested. It can be

stated, that defects like bubbles can be detected. Defects concerning the adhesion of adhesives can not be detected due to a missing phase transition. It is also important that bubbles to be detected should appear close to the steel surface towards the sensor.

Mr. Bufalini presents the test programme to be performed by SZMF and CSM on real scale pipes. The test programme got the acceptance of the project group.

TOP 3: Next steps

Sika Danmark A/S will continue the development of an adequate adhesive.

Tests on small scale pipe specimens have to be continued to optimise the joint geometry and the application method including curing method. Additionally to torsion tests and tests under cyclic loading, bending tests shall be performed. To indicate the influence of ovality, deformed pipes will be used for pipe bonding. Climate and corrosion tests according to VDA 621-415 and PVW 1200 will be performed. Tests will be done using coated pipes. As adhesive, PU156 will be used. These tests will be performed by UPB. UPB will check, where trapped air and bubbles emerge in bonded pipes and provide this information to SZMF.

For dividing the adhesive from the conducted medium, a sealing material has to be chosen (Sika & UPB). Sika will identify an adequate coating for subsequently coating of big pipes.

For starting real scale tests, sleeve production has to be started. This task has to be evaluated by SZMF. Pipes have to be transported to Duisburg to produce the real scale specimens (CSM). First tests for transferring the bonding concept on big pipes will be performed at SZMF in Salzgitter (SZMF & UPB). Specimens for real scale tests will be produced by SZMF under support of UPB. Real scale tests have to be performed.

Gaz de France Suez will provide information concerning cyclic loadings on pipes for setting up a test programme with cyclic loadings. Additionally, Gaz de France Suez will provide detailed information about costs of welding (machine hours, man hours, etc.) for pipe diameters used in the project.

Identification of pilot plants for pipe laying tests will be done by Gaz de France Suez and AGFW. Contact to consulting engineers will be made by AGFW.

TOP 4: Coordination

Mr. Boeddeker explains that a solution has to be found to replace Bohlen & Doyen. Mr. Boeddeker presents the working points to be done by Bohlen & Doyen. The project partners agreed in Mr. Boeddeker's appraisal which points can be handled

without Bohlen & Doyen. For working points, where experiences and skills of construction companies are needed, consulting engineers shall be called. For performing the pipe laying tests, a pilot plant has to be identified. One project partner shall overtake the obligations referring to the pipe laying tests and shall perform the pipe laying tests by hiring a subcontractor. First, costs for this solution have to be estimated.

For preparing the mid-term report, Mr. Boeddeker requests the elaborated report modules concerning the research results of the project partners until the 30th January 2009. The financial statements shall be provided until the 30th January as well.

The next project team meeting will take place in Fredensborg at Sika Danmark A/S on the 2nd and 3rd of June 2009.

TOP 5: Tour of Centro Sviluppo Materiali

Mr. Bufalini shows the laboratories and testing facilities at the site of Centro Sviluppo Materiali in Rome.

TOP 6: Miscellaneous & end of the meeting

Mr. Boeddeker thanks all participants on the meeting for their constructive work and discussions.