

MMS7 Towards an Adhesives Design Toolkit

Notes of 2nd Industrial Advisory Group (IAG) Meeting held on 4 December, 2002 at NPL, Teddington. Prepared by R S Court, TWI.

PERSONS PRESENT

John McCarthy	AEA Technology
Dubravko Nardini	Alcan
Peter Padelopoulos	Anvil Innovations
Jeff Kapp	For
John Harris	MERL
Elena Arranz	NPL
Bill Broughton	NPL
Louise Crocker	NPL
Greg Dean	NPL
Bruce Duncan	NPL
Sam Gresham	NPL
Maria Lodeiro	NPL
Richard Mera	NPL
Jeannie Urquhart	NPL
Richard Roberts	Pira
Alan Hickman	Quotec
Terry Twine	RSC
Ewen Keller	TWI

APOLOGIES RECEIVED FROM

Bernard Sikkell	3M
John Hunter	Alcan
Dave Dixon	BAe
Peter Godfrey	Caswell
Joan Cocksedge	DTI
Mike Lavery	Evode
Martin Fakely	Permabond
Steve Abbott	SATRA
Shaun Hurley	Taywood
Richard Court	TWI

1. INTRODUCTION, WELCOME AND AGREEMENT OF AGENDA

Richard Roberts (Pira) as chairman welcomed the attendees. The Agenda for the meeting was agreed.

This second meeting of the DTI funded Measurement for Materials Systems, MMS7 project - Towards an Adhesives Design Toolkit, was held in conjunction with other adhesives related projects within the MMS programme. These other projects were: MMS8 – Interfacial Adhesion Strength and MMS11 – Fatigue and Creep in Joined Systems. The minutes from these two projects can be found on the NPL website at <http://www.npl.co.uk/npl/cmmt/cis/mms8/mms8intro.html>.

2. ACCEPTANCE OF NOTES OF THE LAST MEETING

No comments were received for alterations to the minutes of the first IAG meeting held on 17 July '02. Minutes from this second meeting should also be placed on the web-site.

Action 2.1: Richard Court to place a copy of the minutes from this second meeting on the Adhesives Toolkit website. <http://www.adhesivestoolkit.com/Information/Minutes-4-Dec-02.pdf>

3. REVIEW OF ACTIONS FROM LAST MEETING

All actions from the first meeting were completed.

4. REVIEW OF PROJECT PROGRESS

4.1 Overall project progress

Ewen Kellar (TWI) began with an introduction on how the Adhesives Toolkit project could benefit industry by increasing confidence in the use of adhesives as well as providing help in areas such as adhesive selection, stress analysis, training and costing. He presented the project deliverables.

Results were reported of a survey asking companies from various industry sectors what they expect from the toolkit (Presentation is on http://www.adhesivestoolkit.com/Information/MMS7IAG204_12_02.pdf).

Ewen gave a live demonstration of the structure and contents of the www.adhesivestoolkit.com website so far and invited members to visit it and make suggestions. The dissemination activities that had already taken place were also detailed.

4.2 Task 4c Failure criteria. Task 5 A database for adhesives.

In the first part of his presentation Greg Dean (NPL) talked about the prediction of failure in adhesive joints and how the accuracy depends on the validity of the failure criterion and the materials model used in the stress analysis. He illustrated with graphs the fact that different materials models give different predictions of stress. Models for toughened adhesives are not accurate because they do not account for rubber cavitation. Incorporating the cavitation model in ABAQUS predictions are more accurate.

Greg described how failure criteria data are evaluated by comparing with experimental results for different joint geometries. He reported on five possible failure criteria and showed FEA predictions according to the maximum principal stress criterion using the exponent Drucker Prager and the cavitation models illustrating that the choice of model can affect the location of the predicted locus of failure initiation. Also using both models, he presented a table comparing the maximum values of strain and stress for different joint geometries. He concluded this part saying that according to the results table identifying a failure criterion is still the matter of further research. It was suggested that the toolkit could provide advice on limits for safe operational loads.

On the second part he presented his proposals on a database for adhesives. The database will specify data for each adhesive and identify test methods for its measurement. Greg suggested that initially it could be restricted to structural adhesives. He also showed examples of data tables to give an idea of how the database would appear.

4.3 Adhesive Selection. Analysis Module

John McCarthy (AEA Technology) outlined the key points of a previous meeting with Ewen Kellar in which they had discussed the structure of the module. They agreed that there should be different search levels for beginners and advanced users. The user will select a supplier to obtain the information about the product and its applications. The module could also ask the user for the materials and surfaces to be bonded and give advice on temperature conditions and surface treatments. Feedback was requested from the audience.

On the second half he reported on the progress of the Analysis module. So far, the module calculates shear stresses and strains in a coaxial joint. The user will have to insert the adhesive and adherend properties as well as the type of loading and the module will calculate the stresses and strains in the adhesive and adherend and produce a table and a graph with the results.

Action 2.2: Richard Court to arrange for a copy of the presentations to be placed on the Adhesives Toolkit website.

http://www.adhesivestoolkit.com/Information/MMS7IAG2_04_12_02.pdf

http://www.adhesivestoolkit.com/Information/MMS7_IAG2_AEATech.pdf

http://www.adhesivestoolkit.com/Information/MMS7_IAG2_NPL.pdf

5. DISCUSSION OF PROJECT AND FUTURE PLANS

Ewen Kellar presented the future planned activities by outlining the proposed modules for the toolkit and demonstrating the proposed Case History Database module being developed at TWI. As before, he asked the IAG members for suggestions and contributions to both structure and content of the module.

After the presentation there were some questions from members of the IAG:

- Peter Padelopolos (Anvil Innovations) asked if the adhesive supplier database could recommend a product and not just a supplier. Ewen Kellar (TWI) replied that the adhesive supplier database's function is to provide a link to a supplier's web site from where product information can be obtained by the user. In theory its capabilities could be expanded to recommend a product but this would be a large undertaking that is beyond the current scope of the Toolkit. Difficulty had already been experienced in obtaining generic product information from suppliers as an email survey intended to gather information for the current version only received 2 replies from 40 recipients! The information in the current version of the database therefore came from a web survey.
- Jeff Kapp (Ford) suggested that it might be useful to be able to search the Case History database using a criterion based upon curing mechanism. It was agreed that this might be useful and will be included.
- Greg Dean (NPL) commented that although the toolkit will not include a capability to perform finite element analysis (FEA) of joints at this time, it might be useful to include advice on performing FEA and in particular what data to use and how to measure it. It was agreed that this and general design advice would be very useful and ways in which this information could be incorporated into the toolkit should be considered.

- Dubravko Nardini (Alcan) stated that the properties obtained from a joint are very dependent upon pre-treatment, and will the toolkit contain advice on pre-treatment? Ewen Kellar (TWI) replied that such information already exists in JoinIT and can be easily included. However, how and where the information is given needs to be carefully considered. For instance advice on pre-treatments might usefully be supplied in an adhesive selector module and in a design module as well as from a main page.
- Jeff Kapp (Ford) asked if the toolkit also give advice on suppliers of (specialist) pre-treatments? It was felt that this is something that would be useful and will be considered for incorporation into the toolkit.
- Bill Broughton (NPL) asked if the toolkit stress analysis module would provide links to other stress analysis packages? It was stated that the module would contain general information about stress analysis and give advice on other packages that are available. However these may not be accessible on-line (the linked web site may contain information on how to obtain them for instance) and if they are available for on-line use, the responsibility for input and output of information will belong to the destination web site.

6. PROJECT FINANCIAL STATUS

Ewen Kellar (TWI) provided an up-date on the project spend and progress, with the project being ahead of target on progress and within budget spend.

7. DTI MATTERS

No comments were made during the meeting.

8. ANY OTHER BUSINESS

No other items were raised.

9. DATE OF NEXT MEETING

The date and venue for the third meeting of the MMS7 IAG will be decided in January 2003, and circulated to the IAG via email and on the Toolkit website.

Action 2.3: Richard Court to circulate details of the third IAG meeting in January 2003.

10. SUMMARY OF ACTIONS

Action 2.1: Richard Court to place a copy of the minutes from this second meeting on the Adhesives Toolkit website.

Action 2.2: Richard Court to arrange for a copy of the presentations to be placed on the Adhesives Toolkit website.

Action 2.3: Richard Court to circulate details of the third IAG meeting in January 2003.