AERC1 Contents

AERC2 Contents

Symposium Program

Page	Time	Activity
		Tuesday, July 18
	8:00	Registration
	9:30	WELCOME
		SESSION I: TESTING
16	10:00	**New Directions in Testing.** *T. J. Fowler, J. A. Blessing, and P. J. Conlisk* (Monsanto Chemical Company, U. S. A.)
28	10:30	**Development of Control Methods by Acoustic Emission in Composite Materials Tubes, Part I.** *C. Hervé, M. Cherfaoui, and J. Roget* (Cetim, France); *M. Truchon* (SneaP, France); *and X. DuFour* (SBPI, France)
33	11:00	**A Procedure for Acceptance Testing of FRP Balsa Wood Core Pressure Vessels.** *P. Ouellette, S. V. Hoa, and L. Li* (Concordia University, Canada)
	11:30	BREAK
		SESSION 2: INSPECTION
42	12:00	**Acoustic Emission Technology for the Development of Composite Materials in Automobile Industry.** *N. Sato* (Toyota, Japan)
52	12:30	**Development of Production Acoustic Emission Evaluation Criteria from Qualification Torque Load Testing of Graphite/Epoxy Power Transmission Shafts.** *J. M. Rodgers* (Hartford Steam Boiler Inspection Technologies, U. S. A.) *and D. W. Okey* (Sundstrand Aviation, U. S. A.)
	13:00	LUNCH
		SESSION 3: CURING
63	14:30	**Acoustic Emission Characterization of Differently Conditioned Carbon/Peek Laminates.** *G. Mensitieri and R. Teti* (University of Naples, Italy) *and G. Borzacchiello and C. Sabatino* (Aeritalia G.V.T., Italy)
73	15:00	**Influence of Environmental Conditions during Materials Processing by Felicity Ratio Measurement.** *A. Lemascon, A. Blazer, and A. Grospierre* (Centre Technique des Industries Mécaniques, France) *and M. C. Yrieix* (Electricité De France - Les Renardières, France)
	15:30	BREAK

SESSION 4: FRICTION

83 16:30 **Sources for Thermally Induced Acoustic Emission.** *S. Nyström and P. A. Gradin* (Swedish Plastics and Rubber Institute, Sweden)

84 17:00 **Distinguishing Acoustic Emission Generated by Actual Damage Progression from Non-Relevant AE in Graphite Epoxy Composites.** *A. Mittelman and I. Roman* (The Hebrew University of Jerusalem, Israel)

WORKS IN PROGRESS

92 17:30 **An Attempt to Analyse Laminate Failure Mechanisms by Acoustic Emission.** *D. Perreux, D. Varchon, and C. Oytana* (Laboratoire de Mécanique Appliquée, France)

97 17:45 **Study by Acoustic Emission of Damage Development in Carbon Fibre Reinforced Composites.** *C. Martin, J. M. Dartyge, and E. Morel* (Institut National de Recherche Chimique Appliquée, France)

Wednesday, July 19

SESSION 5: ENVIRONMENTAL EFFECTS

101 9:00 **Service Life Prediction of Glass Reinforced Plastic under Stress Corrosion Condition by Acoustic Emission.** *L. Golaski* (Technical University of Kielce, Poland) *and J. Ranachowski* (Polish Academy of Sciences, Poland)

109 9:20 **Evaluation of Degradation Behavior on GFRP in Hot Water by Acoustic Emission.** *H. Hamada, Z. Maekawa, and T. Morii* (Kyoto Institute of Technology, Japan)

119 9:40 **Acoustic Emission Analysis of GFR Thermoplastic Composites.** *R. Teti* (University of Naples, Italy) *and K. Bastioli and G. Romano* (Instituto G. Donegani, Italy)

129 10:00 **Environmental Effects on Advanced Fibre Hybrid Composites--an Acoustic Emission Study.** *R. Gopalan, H. N. Sudheendra, and M. R. Madhava* (National Aeronautical Laboratory, India) *and B. Dattaguru* (Indian Institute of Science, India)

137 10:20 **An Acoustic Emission Monitoring of Bending Tests on a Hygrothermal Aged PA66 Matrix/Glass Fibre Composite.** *C. Allie and D. Valentin* (Centre des Materiaux, France)

10:40 BREAK

SESSION 6: AEROSPACE APPLICATION I

144 11:10 **Ariane 4 Spelda--Flight Proving by Acoustic Emission.** *P. T. Cole* (Dunegan Pac, Ltd., Great Britain) *and N. Thomas* (BAe Space & Communications, Great Britain)

151 11:40 **AE Inspection of Carbon-Fiber Reinforced Structures for Aerospace Applications.** *J. Block* (Institute for Structural Mechanics, Federal Republic of Germany)

160 12:10 **Correlation of Felicity Ratio and Strength Behavior of Impact-Damaged Spherical Composite Test Specimens.** *J. W. Whittaker and W. D. Brosey* (Martin Marietta Energy Systems, Inc., U. S. A.) *and M. A. Hamstad* (University of Denver, U. S. A.)

168 12:30 **Felicity Ratio Behavior of Pneumatically and Hydraulically Loaded Spherical Composite Test Specimens.** *J. W. Whittaker and W. D. Brosey* (Martin Marietta Energy Systems, Inc., U. S. A.) *and M. A. Hamstad* (University of Denver, U. S. A.)

12:50 LUNCH

SESSION 7: AEROSPACE APPLICATION II

180 14:20 **Determining the Reliability Increase of Rocket Motors Due to Acoustic Emission Monitoring.** *G. F. Hawkins* (The Aerospace Corporation, U. S. A.)

184 14:50 **Delayed Acoustic Emission: A Rheological Approach.** *N. Rochat, R. Fougeres, and P. Fleischmann* (INSA, France)

WORKS IN PROGRESS

194 15:10 **Acoustic Emission Conditions for Failure Prediction of Winding Carbon Structures.** *C. LeFloc'h and S. Beziers* (Aerospatiale Aquitaine Plant, France)

15:30 BREAK

SESSION 8: AEROSPACE APPLICATION III

200 16:00 **Proof Testing of Unidirectional GFRP Using Acoustic Emission Technique.** *J. J. Masson and D. Valentin* (Centre des Matériaux, France)

207 16:30 **Standard Test to Quantify the Knee in the AE vs. Load Curve as a Material Parameter for Composites.** *J. R. Mitchell* (Physical Acoustics Corp., U. S. A.)

218 17:00 **Acoustic Emission Studies for Precision Composite Spacecraft Structures.** *T. J. Delaney* (Hartford Steam Boiler Inspection Technologies, U. S. A.)

SESSION 9: FRACTURE MECHANICS

227 17:30 **Fracture Behavior and Acoustic Emission Response of Center-Hole GFRP Laminates.** *G. Caprino and R. Teti* (University of Naples, Italy)

228 18:00 **Application of Acoustic Emission for Monitoring Fracture Mechanics in Composite Materials.** *Z. Burzić and M. Zrilić* (Aeronautical Institute, Yugoslavia) *and S. Sedmak and D. Mitraković* (University of Belgrade, Yugoslavia)

Thursday, July 20

SESSION 10: SIGNAL PROCESSING, INSTRUMENTATION

230 9:00 **Pattern Recognition Analysis of Acoustic Emission Signals from Carbon Fiber/Epoxy Composites.** *K. Kawamoto* (Osaka Gas Co., Ltd., Japan) *and K. Ono* (University of California, U. S. A.)

240 9:25 **Acoustic Emission Signal Classification of Graphite/Polyphenylene Sulfide Composite Subjected to Mode II Fracture.** *S. V. Hoa and I. C. Smith* (Concordia University, Canada)

250 9:50 **Statistical Analysis of Acoustic Emission Signals Associated with Fatigue Damage in CFRP Composites.** *A. Maslouhi, C. Roy, and D. Proulx* (Université de Sherbrooke, Canada); *M. Cherfaoui* (Centre Technique des Industries Mécaniques, France); *and D. G. Zimcik* (Canadian Space Agency, Canada)

259 10:15 **Advanced AE Instrumentation System for Versatile and Precise Use by Waveform-Microdata Processing.** *H. Oyaizu and K. Yamaguchi* (University of Tokyo, Japan)

268 10:40 **Recognition on Fracture Modes and Behavior in FRP by AE Waveform-Microdata.** *K. Yamaguchi, H. Oyaizu, J. Johkaji, and Y. Kobayashi* (University of Tokyo, Japan)

11:00 BREAK

SESSION II: CHARACTERIZATION

278 11:30 **Acoustic Analysis of the Accumulation of Cracks in CRFP Cross-Ply Laminates under Tensile Loading.** *J. P. Favre and J. C. Laizet* (ONERA, France)

286 12:00 **Acoustical Detection of Transverse Cracking in a Crossply Composite.** *M. R. Gorman and S. M. Ziola* (Naval Postgraduate School, U. S. A.) *and J. L. Koury* (Air Force Astronautics Laboratory, U. S. A.)

298 12:30 **Energy Distribution Analysis of Acoustic Emission Signals from the Tensile Testing of CFRP.** *O. Y. Kwon and D. J. Yoon* (Korea Standards Research Institute, Korea)

13:00 LUNCH

SESSION 12: MICROANALYSIS: INTERFACES

304 14:30 **Identification of the Acoustic Signals Generated by the Rupture of SiC Fibre/Metallic Matrix Composites.** *M. C. Merienne and J. P. Favre* (ONERA, France)

313 15:00 **Acoustic Emission: A Microinvestigation Technique for Interface Mechanisms in Fibre Composites.** *D. Rouby* (INSA de Lyon, France)

323 15:30 **Analysis of AE-Events from Single Fibre Pull-Out Experiments.** *W. Mielke, A. Hampe, O. Hoyer, and K. Schumacher* (Federal Institute for Materials Research and Testing, Federal Republic of Germany)

16:00 BREAK

SESSION 13: MICROMECHANISMS: METALMATRIX COMPOSITE

332 16:30 **Work Hardening and Fiber-Breaking Induced by Plasticity in a Short Carbon Fiber Pure Aluminum Matrix Composite.** *Y. Kagawa and T. Kishi* (University of Tokyo, Japan) *and P. Fleischmann* (INSA de Lyon, France)

342 17:00 **Acoustic Emission Characterization of the Deformation and Fracture Process of a Metal Matrix Composite.** *O. Y. Kwon* (Korea Standards Research Institute, Korea) *and K. Ono* (University of California, U. S. A.)

350 17:30 **On the Measurement of Large Amplitude Acoustic Emission from 6061 Aluminum/Boron Specimens with a Center Notch.** *H. A. Scarton, G. J. Dvorak, and P. A. Van Laak* (Rensselaer Polytechnic Institute, U. S. A.) *and S. Han* (Tuskegee University, U. S. A.)

Friday, July 21

SESSION 14: INSTRUMENTATION

358 9:00 **Stress Wave Sensing--An Approach to Monitoring Composite Structures Using Simple Integrated Acoustic Emission Systems.** *T. J. Holroyd and N. Randall* (Stresswave Technology, Ltd., Great Britain)

365 9:30 **Acoustic Emission Amplitude Analysis by Logarithmic Rate Cartography.** *Y. Surrel and A. Vautrin* (E.N.S.M., France)

375 10:00 **An Accurate Acoustic Emission Location Method Adapted for Composite Materials.** *A. Bouheraoua* (A.M.D., France)

10:30 BREAK

SESSION 15: ACOUSTO-ULTRASONIC

380 11:30 **An Acousto-Ultrasonic Study on Tensile Failure of Fibre Reinforced Polypropylene Composites.** *P. K. Sengupta and D. Mukhopadhyay* (University of Calcutta, India) *and K. K. Phani and N. R. Bose* (Central Glass & Ceramic Research Institute, India)

386 12:00 **Combined Use of Stress Wave Factors and Acoustic Emission in Tensile Testing of CF/EP and KF/EP.** *B. Melve and T. Berge* (SINTEF, Norway)

392 12:30 **A Comprehensive Guide to the Literature on Acoustic Emission from Composites, Supplement II.** *T. F. Drouillard* (Rockwell International Corporation, U. S. A.)

13:00 OFFICIAL LUNCH

15:00 END OF SYMPOSIUM

Professional Program

Fourth International Symposium on Acoustic Emission From Composite Materials Seattle, WA

Keynote Addresses

Tuesday, July 28, 1992

Session 1 —Material Studies

Session 2 —Material Studies

Session 3—Material Studies

Session 4 —Material Studies

Wednesday, July 29, 1992

Session 1—Structural Integrity –Concrete Applications

Session 2—Structural Integrity Applications

Session 3—Structural Integrity Applications

Session 4—Structural Integrity Applications

Thursday, July 30, 1992

Session 1—Applications–State of Art

Session 2—Applications –Works-In-Progress

Session 3—Applications–Specialized

Session 4—Applications–Wood

Friday, July 31, 1992

Session 1—Signal Analysis

Session 2—Signal Analysis–Literature Review

Symposium Organizing Committee

Chairman:
Mr. Burke Dykes
Boeing Commercial Airplanes
PO Box 3707, MS 47-10
Seattle, WA 98124-2207
(206) 655-8365 (office)
(206) 544-1047 (FAX)

Program and Papers Chairman:
Dr. D. R. Smith Jr.
Boeing Commercial Airplanes
PO Box 3707, MS 9R-58
Seattle, WA 98124-2207
(206) 393-7444 (office)
(206) 393-7457 (FAX)

CARP Chairman:
Prof. M. A. Hamstad
University of Denver
University Park
Denver, Colorado 80208-0177
(303) 871-3191 (office)
(303) 871-4000 (FAX)

Publicity Chairman:
Mr. W.T. Hardrath
Boeing Commercial Airplanes
PO Box 3707, MS 47-10
Seattle, WA 98124-2207
(206) 544-2705 (office)
(206) 544-1047 (FAX)

Pre-Symposium Educational Seminar Chairman:
Dr. Adrian Pollock
Physical Acoustics Corporation, Inc.
PO Box 3135
Princeton, NJ 08543-3135
(609) 896-2255 (office)
(609) 895-9726 (FAX)

Keynote Speakers:
Prof. T. Kishi, Japan
Dr. Pierre Fleischmann, France

Paper Committee:
D. Smith - USA
S. Hoa - Canada
M. Ohtsu - Japan
T. Fowler - USA
T. Crump - USA
J. Lenain - France

International Advisory Committee:
S. Hoa - Canada
I. Roman - Israel
R. Teti - Italy
P. Gradin - Sweden
B. Melve - Norway
P. Cole - United Kingdom
L. Golaski - Poland
J. Lee - Korea
R. Waeber - Germany
J. Lenain - France
K. Ono - United States
T. Kishi - Japan

TUESDAY, JULY 11, 1995

Session 1 - Material Studies

13 **8.45 High Sensor Density Acoustic Emission Monitoring of Graphite/ Epoxy Pressure Vessels**
K.S. Downs, Lockheed Martin; M.A. Hamstad, University of Denver; USA

23 **9.15 Acoustic Analysis of Delamination Propagation in CFRP Cross-Ply Laminates under Static and Cyclic Loadings**
F. Lachaude, L. Michel, B. Lorrain, and R. Barriol, Ecole Nationale Supérieure d'Ingénieures de Construtions Aéronautiques; France

33 **9.45 Acoustic Emission to Monitor Crack Accumulation in Cross-Ply CFRP in Conditions of Mechanical Loading or Thermal Cycling**
J.-P. Favre and C. Raud, Onera Dept. of Materials; France

10.15 Refreshment Break

Session 2 - Material Studies

43 **10.30 Multiple Cracking in Composite Laminates Characterised by Acoustic Emission, Microstructure and Mechanical Response**
S. Andersen and H. Lilholt, Riso National Laboratory; Denmark

51 **11.00 AE and AU Monitoring of Degradation in Composites Due to High Temperature Exposure and Mechanical Loading**
S. Béland, Institute for Aerospace Research; A. Maslouhi and H. Saadoui, Université de Moncton; C. Roy, Université de Sherbrooke; Canada

61 **11.30 A New Approach to Modelling and Analysis for Uncertainty in Acoustic Emission Testing of Composites – Part I**
R. Ganesan and S.V. Hoa, Concordia University; Canada

71 **12.00 Acoustic Emission Characteristics of GFRP Composites as a Function of the Interface Quality and Its Aging**
P. Krawczak and J. Pabiot, Ecole des Mines de Douai; France

12.30 Lunch Break

Session 3 - Material Studies

81 **13.30 Acoustic Emission and Residual Strength in Fatigue Loaded Notched Carbon/Epoxy Composites**
A. Henriksson and J.C. Thesken, FFA; Sweden

91 **14.00 Discrimination of AE Phenomena in Composite Testing**
R. Nordstrom and A.J. Brunner, EMPA Swiss Federal Laboratories for Materials Testing and Research; Switzerland

101 **14.30 Two Parameter Description of the AE-Rate Behavior of Glass-Fibre Reinforced Epoxy and Polyester under Static Tensile Loading**
A.J. Brunner, R. Nordstrom, and P. Flüeler, EMPA Swiss Federal Laboratories for Materials Testing and Research; Switzerland

15.00 Refreshment break

Session 4 - Material Studies

111 **15.15 On Use of Piezoelectric Polymers as Wideband Acoustic Emission Displacement Sensors for Composites**
M. Hamstad, University of Denver; USA

121 **16.30 Mechanical Properties and Acoustic Emission of Al-Fe Matrix Composites**
I. Roman and F. Zeides, The Hebrew University of Jerusalem; Israel; G. Staniek, M. Peters and W.A. Kaysser, DLR; Germany

WEDNESDAY, JULY 12, 1995

129 **8.30 Keynote address "Acoustic Emission as an Aid for Investigating the Deformation and Fracture Mechanisms of Paper"**
Prof. T. Yamauchi, Faculty of Agriculture, Kyoto University; Japan

Session 1 - Material Studies

9.00 The Influence of Polymers on Paper Strength Investigated by the Use of Acoustic Emission Monitoring
S. Forsberg and P.A. Gradin, SCA Research; Sweden

9.15 Investigation of Damage Development in Paper Using Acoustic Emission Monitoring
P.A. Gradin and S. Nyström, SISY; Sweden

139 **9.30 Effect of Temperature on Fracture of Spruce in Compression Using Acoustic Emissions**
J.E. Berg and P.A. Gradin, Mid Sweden University; Sweden

149 **10.00 The Deterioration of Foamglas® under Compression Studied With the Acoustic Emission Technique**
M. Wevers, D. Tsamtsakis, P. DeMeester, and E. Uria, University of Leuven; H. Strauven, Pittsburgh Corning Europe; Belgium

10.30 Refreshment Break

Session 2 - Material Studies

160 **10.45 Acoustic Emission Behavior of Experimental Dental Resin Composite Containing Spherically Shaped Filler Particles**
K.-H. Kim, J.H. Park, Kyungpook National University; M.Y. Choi, Korea Research Institute of Standard and Science; Korea; T. Kishi, The University of Tokyo; Japan

170 **11.15 Acoustic Emission Analysis of Laminate Failure Mechanisms with Reference to Failure Criteria**
L. Golaski, Kielce University of Technology; Poland; K. Ono; University of California; USA

179 **11.45 Acoustic Emission from Composite Laminates With Simple Damage Characteristics**
R. Joffe, J. Varna, and L.A. Berglund, Luleå University of Technology; Sweden

12.15 Lunch Break

Session 3 - Material Studies

187 **13.15 Results of the Acoustic Emission Monitoring of Pre-Cure Contaminated Carbon Fibre Composite Material Tested Using the Interlaminar Shear Test**
S.E. Mason, G.M. Hall, and K.L Watson, University of Portsmouth; UK

197 **13.45 AE Pattern Recognition Analysis of the Fracture of Glass Fibre Composites Exposed to Hot-Wet Conditions**
K. Ono, Q. Huange, and J.-Y. Wu, University of California; USA

205 **14.15 Acoustic Emission as a Predictor of Delamination Criticality**
J.C. Thesken and A. Henriksson, FFA; Sweden

216 **14.45 Acoustic Emission as a Non-Destructive Testing Technique to Follow Up Damage Evolution in SiC Particle Reinforced Aluminum Matrix Composite**
M. Wevers, A. Niklas, M. Surgeon, L. Froyen, and L. Delay, University of Leuven; Belgium

15.15 Refreshment Break

Session 4 - Material Studies

227 **15.30 AE monitoring in Fatigue Tests on Al_2O_3 Reinforced Aluminium Alloy**
A. Aiello, C. Caneva, and F. Stivali, University of Rome "La Sapienza;" C. Santulli, CCR-Euratom; Italy

233 **16.00 Fracture Mechanism Analysis of SiC/SiC Composites in ILSS Test by AE Spherical Radiation Pattern Method**
Y.T. Lee, S.T. Kim, and T.S. Lee, Yeungnam University; M. Shiwa, JAPEC Research Center; T. Kishi, The University of Tokyo; Korea

240 **16.30 Acoustic Emission Study of Micro-Failure Mechanisms of Dual Basalt Filaments Reinforced Epoxy Composites (DFC)**
J.-M. Park, Gyeongsang National University; J.-H. Lee, Pusan National University; Korea

THURSDAY, JULY 13, 1995

253 **8.30 Keynote address "Acoustic Emission Testing Trials Onboard Offshore Platforms"**
B. Melve, Statoil; Norway

Session 1 - Structural Integrity

262 **9.00 Acoustic Emission Testing of a Fullscale Fighter Aircraft**
M. Knuuttila and D. Lindahl, Saab Military Aircraft; Sweden

263 **9.30 Revisions to the CARP Recommended Practice for Tanks and Vessels**
T. Fowler, The University of Texas at Austin; USA

273 **10.00 Techniques for Using Acoustic Emission to Produce Smart Tanks for Natural Gas Vehicles**
J.R. Mitchell, Physical Acoustics Corp.; N. Newhouse, Brunswick Composites; USA

10.30 Refreshment Break

Session 2 - Structural Integrity

289 **10.45 Localization of Acoustic Emission at Fracture Fibre Composites**
V.S. Krivobodrov, Research Centre "Composite;" Russia

293 **11.15 Fracture Mechanisms of FRPC by Means of AE Monitoring (Effects of Nozzle Diameter and Screw Design)**
M. Suzuki, S. Kida, and M. Wakamatsu, Kanazawa Institute of Technology; Japan

302 **11.45 AE Monitoring During Cure Cycle of Metal/Metal (2024 T3 Alloy) Adhesive Joints for Quality Assessment**
C. Santulli and G. Solomos, Emea, CEC Joint Research Centre; A. Calabrò, CIRA; C. Caneva, University of Rome; L.D. Antonio, ALENIA; Italy

12.15 Lunch Break (Advisory Committee Meeting)

Session 3 - Concrete Applications

312 **14.00 Use of Acoustic Emission to Study Fatigue Damage of Concrete**
B. Redjel, University of Annaba; Algeria

322 **14.30 Effects of Silica Fume Additions on Mechanical Performances of Concrete Composites - Investigations by AE and gas permeability**
R. Pérami, F. Bosc, and W. Prince, Université Paul Sebatier de Toulouse; France

15.00 Refreshment Break

Session 4 - Concrete Applications

332 **15.45 AE Generating Behavior under Concrete Placement and Application to Process Control**
M. Ohtsu, Kumamoto University; Y. Murakami, Hazama Corp.; S. Yuyama, Nippon Physical Acoustics Ltd.; Japan

340 **16.15 Synthetic Fibre Reinforced Cement Composites A Study of Fracture Processes by the AE Method**
I. Rudzinski and L. Golaski, Kielce University of Technology; Poland

FRIDAY, JULY 14, 1995

Session 1 - Structural Integrity

349 **8.30** **Differences in Generation and Detection of Acoustic Emission Based on a Large Number of AE Sensors on Graphite/Epoxy Pressure Vessels**
K.S. Downs, Lockheed Martin; M.A. Hamstad, University of Denver; USA

359 **9.00** **Acoustic Emission Measurements for Verification of Failure Computations in Stiffened Composite Panels**
I.C. Skrna-Jakl and F.G. Rammerstorfer, Vienna University of Technology; E.K. Tschegg, Inst. of Lightweight Structures; Austria

369 **9.30** **Damage Accumulation and Acoustic Emission During Creep in Pressurized Glass Fibre Reinforced Epoxy Pipes**
R. Anderssen, P. Nygård, and B. Melve, C.G. Gustafson, Norwegian Institute of Technology; Norway

379 **10.00** **Acoustic Emission from Defects in Adhesive Tubular Joints in Glass Fibre Epoxy Pipes**
B. Moursund, Norsk Hydro; B. Melve, Statoil; Norway

10.30 **Refreshment Break**

Session 2 - Concrete Applications

385 **10.45** **On the Application of the Acoustic Emission Method for the Prognosis of Hard Concrete at Early Ages**
E.G. Nesvijski, Protecs International Co.; USA

393 **11.15** **Inspection, Diagnosos, Monitoring of Reinforced Concrete Structures and Construction by the Acoustic Emission Method**
G. Muravin and L. Lezvinsky, MPD; Israel

403 **11.45** **SiGMa Analysis of Fracture Process Zone in Notched Concrete Beams**
M. Shigeishi and M. Ohtsu, Kumamoto University; S.Yuyama, Nippon Physical Acoustics Ltd.; Japan

12.15 **Summary and Concluding Remarks**

AECM–6 Symposium Program

MONDAY, 1 JUNE 1998
EDUCATIONAL SEMINAR
Introduction to Acoustic Emission in Composite Materials
A one-day educational seminar that will provide background information for those new to the field of acoustic emission from composites, and will summarize existing codes and standards.
Chair: Raymond Tobin, Acoustic Emission Inspection

8:30 a.m. **Introduction to Acoustic Emission**
S. Ternowchek, Physical Acoustics

9:15 a.m. **Introduction to Composite Materials**
R. Crawford, Crawford Troy Fiberglass

10 a.m. **Refreshment Break**

10:15 a.m. **Codes and Standards**
T. Fowler, University of Texas at Austin

11 a.m. **Speaker** TBA

11:45 a.m. **Acoustic Emission Testing of Furan RTP**
R. Tobin, Acoustic Emission Inspection, J. Fisher, FMC

12:30 p.m. **Lunch Break** (on your own)

1:30 p.m. **New Concepts for Acoustic Emission Detection and Measurement in Crack Growth in Noisy Environments**
H. Dunegan, Dunegan Engineering Consultants

2:15 p.m. **Speaker** TBA

3 p.m. **Refreshment Break**

3:15 p.m. **Field Test Case Studies**
J. Bustillos, Dow Chemical

4-4:45 p.m. **Acoustic Emission Inspection of Composite Pressure Vessels in the Aerospace Industry**
M. Hamstad, University of Denver

TUESDAY, 2 JUNE 1998
CARP CODES AND PROCEDURES
Chair: Stanley Botten, Independent Testing Lab

8:15 a.m. **Opening Address**
S. Botten, Independent Testing Lab

8:30 a.m. **John Teti Plenary Lecture: Acoustic Emission: A Mature NDT Technology with Worldwide Applications and Standards**
S. Vahaviolos, Physical Acoustics Corporation

9:10 a.m. **Acoustic Emission Testing of Carbon Fiber Composite Offshore Drilling Risers** 13
C. Barnes, G. Ramirez, University of Texas at Austin

9:35 a.m. **Acoustic Emission Testing of ASME Section X FRP Pressure Vessels** 23
M. Droge, Dupont

10 a.m. **Refreshment Break**

10:15 a.m. **Recommended Practice for Acoustic Emission Evaluation of FRP Tanks and Pressure Vessels** 33
T. Fowler, University of Texas at Austin

10:40 a.m. **Summary of Work in Progress: Source Location on Fiber Reinforced Composites**
Y. Promboon, University of Texas at Austin

10:55 a.m. **Recommended Procedure for Determination of Design Strain Limit in FRP Specimens** 34
P. Ziehl, T. Fowler, University of Texas at Austin

11:20 a.m. **Acoustic Emission for Cyclic Damage on FRP Pipes Fabricated Following RTP-1 Methods and Specifications**
G. Ramirez, University of Texas at Austin

RESEARCH AND DEVELOPMENT IN COMPOSITE TESTING
Chair: Thomas Crump, DuPont

WEDNESDAY, 3 JUNE 1998
APPLICATIONS OF CARP TESTING
Chair: Phil Cole, Physical Acoustics Ltd. (United Kingdom)

ACOUSTIC EMISSION DEVELOPMENT IN APPLICATIONS
Chair: Martin Peacock, Matrix Inspection & Engineering

2:00 p.m. **Investigation of Plastic Deformation and Fracture of Porous Metals on the Basis of Acoustic Emission Method**
V. Polyakov, A. Egorav, I. Svistun, S. Shapovalov, Altay State University (Russia)

2:25 p.m. **Fracture Mode Classification in Locally Loaded Cross-Ply CFRP Coupons using Wavelet Transform** 114
Y. Mizutani, K. Nagashima, M. Takemoto, Aoyama Gakuin University (Japan); K. Ono, University of California at Los Angeles

2:50 p.m. **Acoustic Emission Signature Analysis in 4-D Image** 124
E. Nesvijski, Universidade de Santa Maria (Brazil)

3:15 p.m. **Refreshment Break**

3:40 p.m. **Acoustic Emission Testing of RTP-1 Demonstration Vessel**
E. Ternowchek, Physical Acoustics

4:05-4:30 p.m. **Acoustic Emission Testing of GRP Composites Progressively Damaged by Fatigue and Environmental Exposure** 231
J. Hale, G. Kotsikos, University of Newcastle upon Tyne (United Kingdom)

6:30-10 p.m. **Institute of Texan Cultures Symposium Awards Banquet** (optional-see registration form)

THURSDAY, 4 JUNE 1998

ACOUSTIC EMISSION IN CONCRETE APPLICATIONS

Chair: Stanley Botten, Independent Testing Lab

8:30 a.m. **Keynote Speaker: Quantitative Evaluation of Crack and Damage in Concrete by Acoustic Emission** 135
M. Ohtsu, Kumamoto University (Japan)

9:10 a.m. **Acoustic Emission Application for Diagnosis of Deteriorated Concrete of Harbor Structures** 145
A. Ishibashi, K. Matsuyama, Nippon Koei Ltd (Japan)

9:35 a.m. **Acoustic Emission Application for Detecting Steel Corrosion in Reinforced Concrete**
P. Berkowitz, A. Unal, T. Fowler, J. Jirsa, University of Texas

10 a.m. **Crack Extension in Concrete by SiGMA** 153
M. Munwam, M. Ohtsu, Kumamoto University (Japan)

10:25 a.m. **Refreshment Break**

10:45 a.m. **Acoustic Emission Characteristics of Full-Scale Concrete-Piles Under Bending and Shear Load** 163
T. Shiotani, Tobishima (Japan)

11:10 a.m. **Bedrock Observation by Captured Acoustic Emission** 173
T. Shiotani, Tobishima (Japan); K. Monma, Public Works Research Institute (Japan)

11:35 a.m. **Acoustic Emission Monitoring of Reinforced Concrete Structures** 183
C. Barnes, University of Texas at Austin

Noon-1:30 p.m. **Lunch Break** (on your own)

1:30 p.m. **Acoustic Emission Monitoring of Prestressed Concrete Girders** 192
T. Fowler, University of Texas at Austin; L. Yepez, Universidad Catolica de Guayaquil (Ecuador)

1:55 p.m. **Evaluation Criteria for Acoustic Emission Examination of Reinforced Concrete Structures** 201
M. Ohtsu, Kumanmoto University (Japan); S. Yuyama, Nippon Physical Acoustics (Japan); T. Okamoto, Nihon Cement (Japan); T. Kishi, The University of Tokyo (Japan)

2:20 p.m. **Acoustic Emission Testing of Furan RTP**
R. Tobin, Acoustic Emission Inspection

2:45 p.m. **Property Evaluation of Thermal-Sprayed Metallic Coatings for Acoustic Emission Analysis** 211
A. Ishida, M. Takemoto, Aoyama Gakuin University (Japan); K. Ono, University of California at Los Angeles

3:10 p.m. **Sources of Acoustic Emissions in Heterogeneous Materials and Cracking Processes** 221
W. Prince, R. Perami, Universite P Sabatier de Touslouse (France)

3:35 p.m. **Refreshment Break**

3:55-4:30 p.m. **Panel Session:** Discussion on CARP subjects

6:30- 7:30 p.m. **After-Hours Tour of the Alamo** (one ticket included in registration fee, advance registration required)