

www.acun6.org

Important Dates

Online Abstract Submission (extended	By 15 May 2012 to 15 June 2012)
Abstract Acceptance Notification	31 May 2012
Full-length Paper Submission	By 30 Jun 2012
Paper Acceptance Notification	31 Aug 2012
Early Bird Registration	By 31 Jul 2012
ACUN-6 Conference	14-16 Nov 2012

Registration

Early Bird Registration by 31 Jul 2012	AU\$ 880 (general)
	AU\$ 440 (students)
Standard Registration	AU\$ 1100 (general)
	AU\$ 550 (students)
One-day Registration	AU\$ 450

Registering for the ACUN-6 Conference means:

- attending hundreds scientific and professional practice paper presentations.
- learning from international leading keynote lectures.
- joining an event, where both scientific and real business experts are brought together.
- enjoying our social networking events (including : conference reception, conference dinner, three days catering afternoon tea and lunches)

Go to www.acun6.org for more information , to register and to submit your papers.

Contact

A. Prof. Sri BANDYOPADHYAY Conference Chair

School of Materials Science and Engineering University of New South Wales Sydney. NSW 2052. AUS Phone: + 61 2 9385 4509 Fax : + 61 2 9385 5956 Email : s.bandyopadhyay@nsw.edu.au

Dr. Yu BAI Technical Secretary Department of Civil Engineering Faculty of Engineering. Monash University Clayton . VIC 3800. AUS

Faculty of Engineering. Monash Univer Clayton . VIC 3800. AUS Phone : + 61 3 9005 4967 Fax : +61 3 9905 4944 Email : yu.bai@monash.edu

Announcement and Call for Abstracts



COMPOSITE & NANOCOMPOSITES in CIVIL, OFFSHORE and MINING INFRASTRUCTURE

PROCEEDINGS of

the 6th International Composites Conference (ACUN-6) COMPOSITE & NANOCOMPOSITES in CIVIL, OFFSHORE and MINING INFRASTRUCTURE

Edited by: Yu Bai Sri Bandyopadhyay Xiao Ling Zhao Raman Singh Sami Rizkalla





Paper index

File name: 001_The Friction_Acharya.pdf Paper title: The friction and wear behaviour of modified rice husk filled epoxy composite Authors: S.K.Acharya & S.P.Samantrai

File name: 001_Numerical_AL-Zubaidy.pdf Paper title: Numerical simulation of the dynamic behaviour sheet and steel Authors: H. Al-Zubaidy, X.L. Zhao, R. Al-Mahaidi

File name: 001_Composites_Aravinthan.pdf Paper title: Composites in civil infrastructure – R&D to applications Authors: T. Aravinthan

File name: 001_Self-Luminous_Bai.pdf Paper title: Self-luminous fibre-reinforced polymer composites for structural applications Authors: Yu Bai & Chao Ding

File name: 002_Develop_Bai.pdf Paper title: Develop planar and space truss structures using pultruded FRP components – joint design and performance Authors: Xiao Yang, Yu Bai & Xiao-ling Zhao

File name: 001_Analysis_Bandyopadhyay.pdf Paper title: Analysis of the strain rate and temperature effects data on mechanical properties/fracture properties of thermoset resins and their composites Authors: H. Pan, S. Bandyopadhyay

File name: 002_An Understanding_Bandyopadhyay.pdf Paper title: An understanding of properties of CNT-reinforced epoxy composites from research published in the literature Authors: L. Chang, Sri. Bandyopadhyay

File name: 001_Recent_Benmokrane.pdf

ACUN6 – Composites and Nanocomposites in Civil, Offshore and Mining Infrastructure Melbourne 14 – 16 November 2012



Paper title: Recent field applications of FRP composite reinforcing bars in civil engineering infrastructures

Authors: Hamdy M. Mohamed, Brahim Benmokrane

File name: 001_Study_Chang.pdf

Paper title: Study of the fracture toughness of nanoparticles modified epoxy by cutting tests

Authors: H.J. Wang, L. Chang & L. Ye

File name: 001_Electrochemical_Datta.pdf Paper title: Electrochemical corrosion of aluminum metal matrix composites: A Review Authors: Jayati Datta, Srikanta Bandyopadhyay

File name: 001_Effect_Dehghan.pdf Paper title: Effect of fabrication methods on the glass transition temperature of CNT/ epoxy composites: State-of-the-art Review Authors: Masoud Dehghan & Riadh Al-Mahaidi

File name: 001_Effects_Duan.pdf

Paper title: Effects of packing geometry upon the aggregation morphology of sodium cholate on the surface of carbon nanotubes Authors: S. J. Chen, W. H. Duan, F. Collins & X. L. Zhao, M. Majumder

File name: 002_Finite_Duan.pdf Paper title: Finite element modelling of high strain rate effects in epoxy Authors: A.L. Tarulli, A.H. Korayem, S.J. Chen & W.H. Duan

File name: 003_Investigation_Duan.pdf

Paper title: Investigation on the dispersion of carbon nanotubes in solvent media: effect of sonication energy and carbon nanotube diameters Authors: A. H. Korayem, S. Chuah, L. C. Huang, G. Simon, X. L. Zhao & W. H.

Duan

File name: 004_Rheological_Duan.pdf Paper title: Rheological behaviours of graphene oxide reinforced cement composite ACUN6 –Composites and Nanocomposites in Civil, Offshore and Mining Infrastructure Melbourne 14 – 16 November 2012



Authors: Kai Gong, Tuo Tan, Martin Dowman, Lin Qiu, Dan Li, Frank Collins, Wen Hui Duan

File name: 005_Strain_Duan.pdf Paper title: Strain rate effects for strength of geopolymer concrete Authors: K.N. Feng, Z. Pan, D. Ruan, F. Collins, Y. Bai & W.H. Duan

File name: 001_Mechanical_Friedrich.pdf Paper title: Mechanical, electrical and tribological behavior of multiple filler reinforced PPS-nanocomposites Authors: A. Noll & K. Friedrich

File name: 001_Prestressed_Ghafoori.pdf Paper title: Prestressed FRP for fatigue crack arrest in structures Authors: Elyas Ghafoori & Masoud Motavalli

File name: 001_Shear_ Gravina.pdf Paper title: Shear debonding of FRP plates from concrete surface: using modified single lap shear test set-up Authors: S.A. Hadigheh, R.J. Gravina & S. Setunge

File name: 001_Using_Haido.pdf Paper title: Using of developed heterosis finite element to study the behavior of steel fiber reinforced concrete corbels Authors: James H. Haido

File name: 001_Synthesis_Iwamura.pdf Paper title: Synthesis of vertically aligned carbon composite structures in amorphous carbon thin films Authors: E.Iwamura

File name: 001_Experimental_Jiang.pdf Paper title: Experimental investigation on FRP to steel adhesively-bonded joint under tensile loading Authors: X.Jiang, M.H.Kolstein & F.S.K.Bijlaard ACUN6 –Composites and Nanocomposites in Civil, Offshore and Mining Infrastructure Melbourne 14 – 16 November 2012



File name: 001_Fatigue_Jiao.pdf Paper title: Fatigue testing of defected steel beams retrofitted using sandwich layered high and normal modulus CFRP sheets Authors: H. Jiao & H. B. Phan, X. L. Zhao

File name: 001_Geopolymer_Karunasenax.pdf Paper title: Geopolymer concrete with FRP confinement Authors: W. Lokuge, D. Eberhard & W. Karunasena

File name: 001_Effect_Keller.pdf Paper title: Effect of thermal lag on glass transition temperature of polymers during DMA Authors: Wei Sun, Anastasios P. Vassilopoulos and Thomas Keller

File name: 002_Shear_Keller.pdf Paper title: Shear mechanical characterization of balsa wood as core material of composite sandwich bridge deck Authors: M. Osei-Antwi, J. de Castro, A.P. Vassilopoulos & T. Keller

File name: 001_Effect_Khennane.pdf Paper title: Effect of concrete block thickness on the behavior of hybrid FRP concrete beams Authors: A. Chakrabortty & A. Khennane

File name: 001_Fibre_Li.pdf Paper title: Fiber reinforced composites and structures Authors: H. Li, G. J. Xian & Z. Y. Wang

File name: 001_Bond_Liu.pdf Paper title: Bond tests of high modulus CFRP/steel double-strap joints at elevated temperatures Authors: H. Liu, X.L. Zhao, Y. Bai, R. K. Singh, S. Rizkalla and S. Bandyopadhyay

File name: 001_Modeling_Lunn.pdf Paper title: Modeling of FRP-strengthened infill masonry structures Authors: D. Lunn & S. Rizkalla, T. Ueda



File name: 001_Nanocomposite_Ma.pdf Paper title: Nanocomposites as superior adhesives Authors: Qingshi Meng & Jun Ma

File name: 002_Graphene_Ma.pdf Paper title: Graphene platelets-derived polymer composites Authors: Ge Shi, Jun Ma

File name: 001_Carbon_MacLeod.pdf Paper title: Carbon nanotube dispersion using Portland cement-compatible surfactants Authors: A. MacLeod, F. Collins and W. H. Duan

File name: 001_Recent_Manalo.pdf Paper title: Recent developments on fibre composite sandwich structures in civil infrastructure Authors: A.C. Manalo

File name: 001_Development_Mukherjee.pdf Paper title: Development of hard coatings of Si-C-N composite for high performance of materials Authors: S. Mukherjee, A. S. Bhattacharya, S.K.Mishra

File name: 002_Synthesis_Mukherjee.pdf Paper title: Synthesis of Nano-Alumina and reinforcement with CNT for improved mechanical properties Authors: Soumya Mukherjee, S.Mukherjee, A.Pal

File name: 001_Influence_Murugaraj.pdf Paper title: Influence of the nanocomposite interphase region on electron transport in device applications Authors: P. Murugaraj, D. Mainwaring, R. Siegele

File name: 001_Analysis_Natario.pdf Paper title: Analysis of web crippling of litesteel beams strengthened with CFRP Authors: P. Natário, N. Silvestre, D. Camotim, X.L. Zhao



File name: 001_Development_Pal.pdf

Paper title: Development of porosity gradient bio ceramic scaffold Authors: Sumit Kumar Pal, Ritwik Sarkar & Hara Prasad Murty

File name: 001_Effects_Pan.pdf Paper title: Effects of fly ash and silica fume on disintegration of alkali-activated slag at temperature exposure of 50°C Authors: Z. R. Li, Y. Liu, Z. Pan, W. H. Duan & F. Collins, J. G. Sanjayan

File name: 002_Optimum_Pan.pdf Paper title: Optimum mix design of concrete made with dune sand as fine aggregate Authors: F. Luo, Z. Pan, W.H. Duan, X.L. Zhao & F. Collins

File name: 003_Change_Pan.pdf Paper title: Change in microstructure and compressive strength of alkali-activated slag paste at temperature exposure of 50°C Authors: N. Jambunathan, G. Li, Y. Liu, A. H. Korayem, Z. Pan, W. H. Duan & F. Collins, J. G. Sanjayan

File name: 004_The Properties_Pan.pdf Paper title: The properties of fly ash based geopolymer mortars made with dune sand Authors: E. Hunter, A. H. Korayem, Z. Pan, W.H. Duan, X.L. Zhao, F. Collins & J. G. Sanjayan

File name: 001_Geometric_Panda.pdf Paper title: Geometric nonlinear vibration analysis of heated laminated cylindrical panels Authors: S. K. Panda, T. R. Mahapatra

File name: 001_Microwave_Pillai.pdf Paper title: Microwave assisted organic modification and surface functionalization of Phyllosilicates Authors: S. Kesavan Pillai, L. Moyo, S. Sinha Ray & M. Scriba

File name: 001_Sliding_Prasad.pdf



Paper title: Sliding wear behaviour of alumnium-redmud metal matrix composite Authors: Naresh Prasad, S.K.Acharya 001_On the influence_Ramezani

File name: 001_Curved_Prusty.pdf Paper title: Curved composite structures: Investigations on reserve strength Authors: Raju & B. Gangadhara Prusty

File name: 001_On the influence_Ramezani.pdf Paper title: On the influence of temperature on the creep response of sandwich beams with a viscoelastic soft core Authors: Maziar Ramezani & Ehab Hamed

File name: 001_Developments_Satyanarayana.pdf Paper title: Developments in cellulose based materials: Macro/micro to nano Authors: K. G. Satyanarayana

File name: 001_Performance_Sengupta.pdf Paper title: Performance of sand and rubber composite as a natural base isolation system for earthquake protection Authors: Srijit Bandyopadhyay & Aniruddha Sengupta, G. R. Reddy, Vinay Mahadik

File name: 001_Use_Soriano.pdf Paper title: Use of GFRP grid for innovative concrete sandwich panels Authors: J. Soriano, S. Rizkalla, Y. You & J. Kim

File name: 001_Coating_Sorouraddin.pdf Paper title: Coating the inner surface of capillary tubes by molecularly imprinted polymer layers Authors: S.M. Sorouraddin, Dj. Djozan & M.A. Farajzadeh

File name: 001_Effects_Tran.pdf Paper title: Effects of material and design architecture on ballistic resistance of textile composite Authors: P.Tran, T. Ngo, E. C. Yang & P. Mendis, W. Humphries

File name: 002_Numerical_Tran.pdf

ACUN6 – Composites and Nanocomposites in Civil, Offshore and Mining Infrastructure Melbourne 14 – 16 November 2012



Paper title: Numerical modeling of dynamic performance of composite panels subjected to underwater blast Authors: P.Tran, T. Ngo & P. Mendis

File name: 001_Numerical_Xiao.pdf Paper title: Numerical analysis of stress intensity factor in cracked steel plates strengthened with CFRP plate Authors: Q.Q. Yu, Z.G. Xiao, X.L. Zhao, T. Chen & X.L. Gu

File name: 001_Analysis_Xu.pdf Paper title: Analysis of the direct shear failure mode for elastic structural member under external blasts Authors: J. Xu & C. Wu

File name: 001_Roles_Ye.pdf Paper title: Roles of rigid nano-particles and CTBN rubber in toughening DGEBA epoxies with different cross-linking densities Authors: J. Zhang, S. Deng & L. Ye

File name: 001_Behavior_Yu.pdf Paper title: Behavior of FRP-Confined Self-Compacting Concrete under Axial Compression Authors: X.L. Fang, T. Yu, J.G. Teng & L. Lam

File name: 002_Behaviour_Yu.pdf Paper title: Behaviour and modelling of FRP-confined concrete-filled steel tubes under axial compression Authors: Y.M. Hu, T. Yu, J.G. Teng

File name: 003_Hybrid_Yu and Teng.pdf Paper title: Hybrid double-skin tubular columns filled with high strength concrete under axial monotonic compression Authors: B. Zhang, J.G. Teng & T. Yu

File name: 001_Impact_Zhang.pdf Paper title: Impact performance of a new embedded and co-cured composite laminate ACUN6 –Composites and Nanocomposites in Civil, Offshore and Mining Infrastructure Melbourne 14 – 16 November 2012



Authors: Sen. Liang, Y.X. Zhang

File name: 002_Bond-slip_Zhang.pdf Paper title: Bond-slip of FRP reinforcing bars in concrete beams Authors: X. Lin & Y.X. Zhang

File name: 001_Fatigue_Zhao.pdf Paper title: Fatigue strengthening of welded steel connections with longitudinal stiffeners using UHM CFRP laminates Authors: Chao Wu, Xiao Ling Zhao & Wen Hui Duan, Riadh Al-Mahaidi & Mohammad R. Emdad

Dear ACUN-6 Delegates,

To us – the organizers of ACUN-6, it has been an absorbing thrill and exhilarating experience that made all the associated work enjoyable and worthwhile – particularly to learn that a large portion of the world's best and Australia's foremost composites experts are coming to grace the event.

We do extend a very hearty welcome to all our Keynote, Plenary, Invited, Distinguished Contributory, Contributory and Student participants. An event like ACUN-6 cannot happen without active input of many people and that is what the entire proceedings is about.

All the papers included in the conference proceedings were peer-reviewed by experts in the field. A 'regiment' of reviewers have devoted their valuable time to complete their review reports in time and they are gratefully acknowledged in this document.

The Sponsors and Supporters deserve a special mention because they have given us very valuable recognition and encouragement.

ACUN-6 has introduced two Best Paper Awards in the names of the world's premier composites experts/organisations who have illuminated the previous ACUN conferences with their presence.

Thanks are due to Ms. Van Thang for establishing the ACUN-6 website and Ms. Yuzhou Wu for her assistance in preparation of the conference proceedings. On the same token ACUN-6 readily acknowledges the contribution made by Monash University in providing modern facilities including Science Theatres, Catering and Printing Service.

To those who have flown over many seas – trust you will find the venture has been worthwhile, and to all our colleagues from within Australia – it is a great pleasure having you with us again. Wish you all a nice, pleasant and fruitful stay at ACUN-6 in Melbourne, Australia.

Sincerely, Sri Bandyopadhyay, Xiao-Ling Zhao, Raman Singh, Sami Rizkalla Yu Bai 14 November 2012

Table of Contents

Plenary Lectures

1.	Mechanical, Electrical and Tribological Behavior of Multiple Filler Reint PPS-Nanocomposites	forced
	Prof Klaus Friedrich	3
2.	Recent field applications of FRP composite reinforcing bars in civil engin infrastructures	eering
	Prof. Brahim Benmokrane	9
3.	Fiber reinforced composites and structures	
	Prof. Hui Li	17

Prof. Hui Li

Civil Infrastructure

1.	Keynote: Composites in Civil Infrastructure – R&D to Applications	
	T. Aravinthan	31
2.	Keynote: Curved composite structures: Investigations on reserve strength	
	Raju & B. Gangadhara Prusty	41
3.	Keynote: Behaviour and modelling of FRP-confined concrete-filled steel under axial compression	tubes
	Y.M. Hu, T. Yu, J.G. Teng	57
4.	Keynote: Recent developments on fibre composite sandwich structures in infrastructure	i civil
	A.C. Manalo	63
5.	Keynote: Effect of concrete block thickness on the behavior of hybrid concrete beams	FRP
	A. Chakrabortty & A. Khennane	71
6.	Numerical modeling of dynamic performance of composite panels subjecunderwater blast	ted to
5	P.Tran, T. Ngo & P. Mendis	77
7.	Fatigue testing of defected steel beams retrofitted using sandwich layered and normal modulus CFRP sheets	l high
	H. Jiao & H. B. Phan, X. L. Zhao	83
8.	Hybrid double-skin tubular columns filled with high strength concrete under monotonic compression	r axial
	B. Zhang, J.G. Teng & T. Yu	89
9.	Rheological behaviours of graphene oxide reinforced cement composite	
	Kai Gong, Tuo Tan, Martin Dowman, Lin Qiu, Dan Li, Frank Collins, We Duan	en Hui 95 .
10	Shear mechanical characterization of balsa wood as core material of com sandwich bridge deck	posite
	M. Osei-Antwi, J. de Castro, A.P. Vassilopoulos & T. Keller	101

COMPOSITE & NANOCOMPOSITES

in CIVIL, OFFSHORE and MINING INFRASTRUCTURE

Themes

The topics of ACUN-6 will cover all aspects of the science and technology of composite materials, from materials fabrication, processing, manufacture, structural and property characterisation, theoretical analysis, modelling and simulation, materials design to a variety of applications, such as aerospace, automotive, civil infrastructure, packaging, ship-building, and recreational products.

ACUN-6 will bring together the latest research and developments of the complete range of composite materials, including biocomposites, medicalcomposites functional and smart composites, structural profiles and mimicking natural materials.

The reinforcements will range from nano-, micro-, meso- to macro-scale in polymer, metal, ceramic and cementitious matrices.

Topics

The topics include, but are not limited to:

- Aerospace
- Fabrication and manufacturing
- Failure and fracture
- Bio-composites
- Recvcling
- Land and marine Infrastructure
- Cement matrix
- Renewable composites
- Light-weight transportation
- Characterization
- Sensors for health monitoring
- Materials science
- Computational mechanics
- Structure
- Nanocomposites
- Design
- Tailoring
- Natural fibre and matrix
- Elastomer composites
- Vibration damping

- Environment friendly
- Automotive
- Properties and performance
- High & low temperature
- Bio-medical composites
- Reinforcements
- Interfaces and interphases
- Civil infrastructure
- Repair
- Low cost composites
- Codes
- Standards
- Modelling and simulation
- Corrosion prevention
- Synthesis
 - Nanotubes
 - Deterioration
 - Testing
 - Polymer, metal, and ceramic matrix



City/Country : Melbourne - Australia : 14th - 16th November 2012 Date Venue : Monash University Clayton Campus. Clayton VIC 3800.

Organisation

A. Prof. Sri BANDYOPADHYAY

Conference Chair School of Materials Science and Engineering UNSW, Australia Phone: +61 2 9385 4509; Fax: +61 2 9385 5956 Mobile: +61 414 751 755 Email: s.bandyopadhyay@unsw.edu.au

Prof. Raman SINGH

Chair of Composites Division **Department of Mechanical Engineering** Monash University, Australia Phone: +61 3 9905 3671 Email: Raman.Singh@monash.edu.au

Dr. Yu BAI

Technical Secretary Department of Civil Engineering Monash University, Australia Phone: +61 3 9905 4987; Fax: +61 3 9905 4944 Email: yu.bai@monash.edu.au

Call for Papers

Prof. Xiao-Ling ZHAO Chair of Infrastructure Division

Department of Civil Engineering Monash University, Australia Phone: +61 3 9905 4972; Fax: +61 3 9905 4944 Email: ZXL@monash.edu.au

Prof. Sami RIZKALLA

Chair of International Committee Department of Civil, Construction and Environment Engineering, NCSU, USA Phone: +919 513 4336; Fax: +919 513 1765 Email: sami.rizkalla@ncsu.edu

Authors or organisations interested in submitting papers are invited to submit an abstract of no more than 300 words outlining the aims, contents and conclusions of their paper or presentation. All proposals will be reviewed by the Conference Committee. Presentations will be selected to provide a program that offers a comprehensive and diverse treatment of issues related to the conference theme. Authors will be notified by email of the outcome of their abstract submission.

1. Abstracts should contain a maximum of 300 words and must be submitted

2. All the submitted papers will be peer-reviewed and accepted ones will be included in the conference proceeding after registration.

3. Abstracts can be submitted via the conference website or email (as Ms. Word file) to :

Dr. YU BAI at yu.bai@monash.edu and cc to

Dr. SRI BANDYOPADHYAY at s.bandyopadhyay@unsw.edu.au

