

# ORGANIC COMPOSITE MATERIALS

Advanced course

**PROFESSOR MARC J.M. ABADIE**

(Instructor)

**NANYANG TECHNOLOGICAL  
UNIVERSITY,  
SINGAPORE**

Local Advisor:

Dr Teresa Mata

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30 JUNE - 01 & 03 JULY, 2011 (3 DAYS COURSE) / ALGARVE-PORTUGAL



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# ABOUT THE COURSE

## **COURSE OBJECTIVES:**

The 3-day intensive course is aimed at presenting and review in depth the three major and essential parts of a composite : matrices, reinforcement agents and interface/interphase of the matrix/reinforcement agent. Relationship between these different parameters and their respective influence on the final mechanical properties will be discussed.

## **WHO SHOULD ATTEND THE COURSE:**

The course is aimed at engineers and research scientists who are involved in the concept of composite products to solve engineering problems of the aeronautical, automobile, mechanical, civil and other engineering industries.

## **BENEFIT OF ATTEND THIS COURSE:**

Have a better understanding of a composite and how the reinforcement agent can strengthen a material

## **COURSE CONTENTS :**

**INTRODUCTION –  
PLASTICS EVERYWHERE**

**PART I.  
REMINDERS ON POLYMER SCIENCE**

**PART II.  
BASIC CONCEPTS**

**PART III.  
COMPOSITE STRUCTURES – KINETICS**

**PART IV.  
BONDING & STRENGTH OF COMPOSITES**

**PART V.  
COMPOSITES MANUFACTURING**

**PART VI.  
CALCULATIONS**

**PRELIMINARY SUGGESTED READINGS :**  
Basics in Polymer chemistry

## **PROFESSOR MARC J.M. ABADIE (INSTRUCTOR)**

Nanyang Technological University,  
Singapore



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Currently Marc J.M. ABADIE is "Michael Fam" Visiting Professor at the School of Materials Science & Engineering at Nanyang Technological University in Singapore.

Marc J.M. ABADIE was Full Professor (1st class) at University Montpellier 2, Science and Technology of Lanquedoc and Head of Laboratory of Polymer Science and Advanced Organic Materials - LEMP/MAO –

- o Doctor **honoris causa** from "Gh. Asachi" Technical University in Iasi - Romania.
- o Emeritus Professor from Université Montpellier II S.T.L. and " POLYTEHNICA " University of Bucharest.
- o Member of International Eurasian Academy of Sciences.
- o Honour Member from Ukraine Academy of Sciences.
- o Emeritus Professor @ Université Montpellier II S.T.L..

### **Qualification**

A Chemical engineer from Pasteur University of Strasbourg (F) in 1961, Professor Abadie received his Master of Science (1961) and PhD 1963 (3<sup>rd</sup> cycle) and later his Doctorat es Science. on "Oxidative Degradation of PS by gamma Ray" in 1972 at the "Centre de Recherche sur les Macromolécules" CRM in Strasbourg (F) - Institut Charles Sadron, Pr Henri Benoit as adviser.

### **Professional Expertise**

He was successively :

- o Engineer R & D at SNPA/Total (1963 - 1967)
- o Research Fellow at CNRS/CRM (1967 - 1972)
- o Associate Professor at U. Montpellier (1972 - 1975)
- o Senior Scientist Officer at "Propellants, Explosives and Rocket Motor Establishment" PERME/UK Ministry of Defence at Waltham Abbey - UK (1975 - 1976)
- o Professor at U. Algiers and Director of Laboratory of Polymer Science (1976 - 1980)
- o Professor at U. Montpellier (1980 - 1982 and 1987-2007)
- o IBM'er in Endicott NY, USA (1982 - 1986)
- o Michael Fam Fellow, Visiting Professor @ NTU, Singapore (2001 & 2005-2011)
- o Emeritus Professor at U. Montpellier (since 2009)

## Relevant Expertise

Professor Abadie's present research concerns : Composites & Nanocomposites, High Performance Polymers, Adhesives, Photosensitive Products, Photoresists, Photocalorimetry and Biomaterials.

o He is/was consultant for IBM, DuPont Electronics, Ethyl Corp. and Dental Medical Diagnostic Systems in the USA.

o He is/was consultant for Rhône-Poulenc, Elf, LETI, Stento, Delta, IBM, SPAD, Ivoclar AGP, Celliose, Gem Plus, Euracil and Veritas in France; Wacker Chemie GmbH in Germany & Lamberti spa in Italy.

o Over 370 papers (372 peer reviewed publications), 11 books and 9 patents.

o He received the 1991 ADER Award for transferring technology to the Industry.

o He is appointed Expert Witness and Expert to the Commission of the European Communities.

o Nominated by the French Government Official Examiner in Chemistry to the Concours at "Ecole Polytechnique" (1991-1997).

o He created in 1988 STEPI "European Technical Symposium on Polyimides and other High-Performance Polymers" which held in Montpellier every other two/three years; last STEPI 7 was held on May 9-11, 2005 ; the next one - STEPI 8 was on June 9-11, 2008 @ Polytech'Montpellier, France; next STEPI, STEPI 9 will be in May 2011.

## Thesis

16 Thesis "Doctorat es Sciences" - 8 Thesis "Doctorat Ingénieur" - 26 PhD Thesis

32 "Mémoires d'Ingénieur" - 61 "Diplômes d'Etudes Approfondies"

in 2001 : 3 PhD thesis and 1 DEA, in 2002 : 1 PhD thesis, in 2003 : 1 PhD thesis, in 2004 : 1 PhD thesis, in 2005 : 2 thesis and in 2006 : 3 thesis

## Recent Award

**Dedicated to the 70th birthday of Professor Marc J.M. Abadie**

**Contents : October 2009, Volume 21, No. 5**

**Recent Publications (2008-2010)**

**338 - Preparation and Characterization of Sulfonated Polyphenylquinoxalines**

A.L. Rusanov, N. M. Belomoina, N. A. Yanul', D. Yu. Likhatchev, C. Iojoiu, J-Y Sanchez & Marc J.M. Abadie  
High Performance Polymers. OnlineFirst [PDF] ; 0:0954008307082446v1 (2008)

**339 – Aromatic Polyethers Based on 3,5-Dinitodiphenylsulfone**

A.L. Rusanov, L.G. Komarova, M.P. Prigozhina, A.A. Askadskii, S.A. Shevelev, M.D. Dutov, O.V. Serushkina, V.Yu. Voytekunas and M.J.M. Abadie

Polymer Science, Ser. B, vol 50, Nos. 3-4, 77-74 (2008)

Vysokomolekulyarne Soedineniya, Ser. B, Vol. 50, N°3, 553-558 (2008)

**340 - Effect of Filler Type, Content and Size on the UV Photocuring Dental Materials**

Zoubida Seghier, Ambroise Diby, Vanda Yu. Voytekunas, Philip H. N. Cheang & Marc J.M. Abadie  
Journal of Chemistry & Chemical Technology, Vol. 2, N°1, 15-18, 2008

**341 - Proton-Conducting Polymers and Membranes Carrying Phosphonic Acid Groups**

Alexandre L. Rusanov, Petr V. Kostoglodov, Marc J. M. Abadie, Vanda Yu. Voytekunas and Dmitri Yu. Likhachev  
Advances in Polymer Science. Publisher, Springer Berlin / Heidelberg (2008) [http://dx.doi.org/10.1007/12\\_2008\\_131](http://dx.doi.org/10.1007/12_2008_131)

**342 - New Metalized Polyimide Films - Structure & Physical Properties**

Saule K. Kudaikulova, Rinat Isakov, Elena Vecherkina, Bulat A. Zhubanov, Oleg Prikhodko, Andrey Kurbatov, Tleuken Akhmetov, Sergey Bazhenov, Irina Razumovskaya, Alain Perichaud, Vanda Yu. Voytekunas, Vitali Lipik & Marc J.M. Abadie  
The Open Chemical Engineering Journal, Bentham Open, 2, 67-73, 2008

**343 - The Application of Thiol-ene Reaction on Preparing UV Curable Bismaleimide-containing Liquid Formulations**

Shiliang Fan, Freddy Y.C. Boey & Marc J.M. Abadie  
Eur. Polym. J., Vol. 44, issue 7, pp. 2123-2129, 2008

**344 - A possible new ultrasonic thermo-pellicular effect and applications**

T. A. Iclanzan, D. V. Stan and M. J. M. Abadie

**Journal International Journal of Material Forming**

**Publisher Springer Paris / ISSN 1960-6206 (Print) 1960-6214 (Online)**

**Category Symposium MS11: Processing of polymers / DOI 10.1007/s12289-008-0282-y**

**Subject Collection Engineering / Springer Link Date Tuesday, April 08, 2008**

**345 - Thermo-destruction in the surface layer of polyvinyl chloride during extrusion**

Vitali T. Lipik, Marc J.M. Abadie & Nikolay R. Prokoptchuk

Journal of Applied Polymer Science, Volume 109 Issue 4 , pp. 2065 – 2745, 15 August 2008

**346 - Kinetic Study of the UV-initiated Cationic Polymerization of Cycloaliphatic Diepoxide Resins**

Vanda Yu. Voytekunas, Feng Lin Ng & Marc J.M. Abadie

Europ. Polym. J., Vol. 44, issue 11, pp. 3640-3649, 2008

**347 – Sulfonated Polynaphthylimides as Proton-Conducting Membranes for Fuel Cells**

A.L. Rusanov, E.G. Bulycheva, M.G. Bygaenko, V.Yu. Voytekunas, M.J.M. Abadie  
Russian Chemical Reviews, Vol 78 (1), pp. 53-75 , 2009

**348 - Polymeric Microcapsules with Potential for Materials Self-healing**

A. Périchaud, R. Iskakov, M.J.M. Abadie, V.Yu. Voytekunas  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion, pp. 356-360 (2009)

**349 - New Sulfonated Dinitrocompounds And Sulfonated Poly(Arylene Ethers) Therefrom**

A.L.Rusanov, L.G.Komarova, M.P.Prigozhina, A.E.Osolodkov, V.A.Tartakovskiy, S.A.Shevelev, M.D.Dutov, O.V.Serushkina, V.A.Mezhnev, C.Iojoiu, J.-Y.Sanchez, V.Yu.Voitekunas, M.J.M.Abadie  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp.45-55 (2009)

**350 - New Polyphenylquinoxalines Based On TNT-Derived 3,5-Bis(Phenylglyoxalyl)Diphenyl Sulfide**

A.L.Rusanov, E.G.Bulycheva, M.A.Kim, E.A.Solodova, S.A.Shevelev, I.L.Dalinger, I.A.Vatsadze, V.Yu.Voytekunas, M.J.M.Abadie  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp. 63-68 (2009)

**351 - New Sulfonated Diamines And Sulfonated Polynaphthylimides Therefrom**

A.L.Rusanov, E.G.Bulycheva, M.G.Bugaenko, V.A.Tartakovskiy, S.A.Shevelev, M.D.Dutov, O.V.Serushkina, V.A.Mezhnev, C.Iojoiu, J.-Y.Sanchez, V.Yu.Voitekunas, M.J.M.Abadie  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp. 79-89 (2009)

**352 - Aromatic Nucleophilic Nitrosubstitution Activated From The Meta Position For The Synthesis Of Poly(Arylene Ethers)**

A.L.Rusanov, L.G.Komarova, M.P.Prigozhina, V.A.Tartakovskiy, S.A.Shevelev, M.D.Dutov, O.V.Serushkina, M.J.M.Abadie, V.Yu.Voitekunas  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp. 90-107 (2009)

**353 - Synthesis And Features Of Thermal Imidization Of Polyimide Compositions**

A.I. Hloba, E.T. Krutko, M. J.M. Abadie  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp. 145-152 (2009)

**354 - The Ultrasonic Thermo-Pellicular Effect In Plastics Technology**

T.A. Iclanzan, D.V. Stan, M.J.M. Abadie  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp. 337-342 (2009)

**355 - Copolymers Of Acrylates And Polyheteroarylenes Obtained By Radical Photopolymerization**

M.J.M.Abadie, D.A.Sapozhnikov, V.Yu.Voytekunas, T.V.Volkova, A.A.Sakharova, R.G. Gassanov, Ya.S.Vygodskii  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp. 301-312 (2009)

**356 - Kinetics Studies of UV-Curable Epiclone Hp-7200 Based Resin Systems**

V.Yu. Voytekunas, F.L. Ng, C.L. Koh, M.J.M. Abadie  
8th International Technical Symposium on Polyimides and High Performance Polymers - STEPI 8, Montpellier 9-11 June (2008) - STEPI 8 Book, MJM Abadie & B Sillion Ed., pp. 321-336 (2009)

**357 - Cationic Photo-polymerization of Biodegradable Poly ( $\epsilon$ -caprolactone)**

Sing Shy Liow, Leonardus K. Widjaja, Vitali T. Lipik & Marc J.M. Abadie  
eXPRESS Polymer Letters, Vol 3, No 3, pp. 159-167 (2009)

**358 - Copolymers Formation by Photopolymerization of (Meth)acrylates Containing Dissolved Polyheteroarylenes**

Dmitriy A. Sapozhnikov, Tat'yana V. Volkova, Antonina A. Sakharova, Rashid G. Gasanov, Jean-Yves Sanchez, Vanda Yu. Voytekunas, Marc J.M. Abadie, Yakov S. Vygodskii  
International Journal of Polymer Science., vol. 2009, Article ID 527046, 11 pages, doi:10.1155/2009/527046 (2009)

**359 - Kinetic Analysis of UV-curable Epoxy Resins for Micromachining Applications** Voytekunas Vanda Yu., Ng Feng

Lin, Koh Chai Ling & Abadie Marc J.M.  
Advanced Materials Research, vol. 74, pp 299-302 (2009)

**360 - Photoinduced polymerization of dental composite materials: Kinetics and optimization.**

Vitali T. Lipik, Vanda Yu. Voytekunas, Marc J. M. Abadie  
Encyclopedia of Polymer Composites: Properties, Performance and Applications. Series : Polymer Science and Technology - Editors: Mikhail Lechkov and Sergej Prandzheva. 2009 4th Quarter

**361 - Manufacturing technique of composite material based on wood and polymer**

Vitali T. Lipik, Marc J. M. Abadie  
Encyclopedia of Polymer Composites: Properties, Performance and Applications. Series : Polymer Science and Technology - Editors: Mikhail Lechkov and Sergej Prandzheva. 2009 4th Quarter

**362 - Diallyl Tartrate as a Multifunctional Monomer for Biopolymer Synthesis**

Kanishka I. K. Herath, Lay Poh Tan, Christina L. L. Chai & Marc J. M. Abadie  
Journal of Biomaterials Science : Polymer Edition, Journal of Biomaterials Science 21 (2010) 1459–1481

**363 - Synthesis of Biodegradable Thermoplastic Elastomers BTPE Based on  $\epsilon$ -Caprolactone**

Vitali T. Lipik, Leonardo K. Widjaja, Sing S. Liow, Subramanian S. Venkatraman & Marc J.M. Abadie  
eXPRESS Polymer Letters, Vol. (2009), N° 32-38 (2010)

**364 - New Sulfonated Polynaphthylimides: Synthesis and Investigation"**

A.L. Rusanov, E.G. Bulycheva, M.G. Bugaenko, A.Yu. Leikin, S.A. Shevelev, M.D. Dutov, O.V. Serushkina, V.Yu. Voytekunas, M.-J.-M. Abadie  
Vysokomol. Soyed., C 2009, V. 51, N7, PP. 1254-1259 (2009)

**365 - New Polyaryleneoxides Containing Sulfonic Acid Side Groups**

A.L. Rusanov, L.G. Komarova, M.P. Prigozhina, E.G. Bulycheva, M.G. Bugaenko, A.E. Osolodkov, S.A. Shevelev, M.D. Dutov, O.V. Serushkina, V.V. Mezhnev, C. Iojoiu, J.-Y. Sanchez, V.Yu. Voytekunas, M.-J.-M. Abadie  
Vysokomol. Soyed., A 2009, V. 51, N12, PP. ...? (2009)

**366 - TNT-Based Sulfonated Polynaphthylimides Useful as Proton Exchange Membranes for Fuel Cells (PEMFCs)**

Alexander L. Rusanov, Vladimir A. Tartakovskiy, Elena G. Bulycheva, Margarita G. Bugaenko, Jean-Yves Sanchez, Cristina Iojoiu, Vanda Yu. Voytekunas & Marc J.M. Abadie  
J. Chem. and Chem. Tech., V, 1, pp.....? (2010)

**367 – New Poly(arylene ether)s Containing Side Sulfo Groups**

A.L. Rusanov, L.G. Komarova, M.P. Progozhina, E.G. Bulycheva, M.G. Bugaenko, A.E. Osolodkov, S.A. Shevelev, M.D. Dutov, O.V. Serushkina, V.V. Mezhnev, J.-Y. Sanchez, C. Iojoiu, V. Yu. Voytekunas & M.J.M. Abadie  
Polymer Science, Ser. B, Vol. 51, Nos. 11-12, pp. 465-470 (2009)  
Vysokomolekulyarnye Soedineniya, Ser. B, Vol. 51, No. 12, pp. 2172-2177 (2009)

**368 - Photochemical crosslinking of the low molecular weight vinylcontaining polysiloxanes with organic azides**

Nadezda V. Zelentsova, Sergei V. Zelentsov, Mark J.M. Abadie, and Elena N. Makareeva  
Third Internet Conference on Photochemistry and Photobiology, **November 24-Dec 24 2000**, pp. 1-8 -  
<http://www.photobiology.com/photobiology2000/zelen2/>

**369 - Thermoplastic Biodegradable Elastomers Based on  $\epsilon$ -Caprolactone and L-Lactide Block Copolymers: A New Synthetic Approach** - Vitali T. Lipik, Kong Jen Fong, Sujay Chattopadhyay, Leonardus K. Widjaja, Sing S. Liow, Subramanian S. Venkatraman and Marc J.M. Abadie – Accepted for Publication in Acta Biomaterialia (2010)

**370 - Effects of transesterification and degradation on properties and structure of polycaprolactone-poly lactide copolymers.**

Vitali T. Lipik\*, Leonardus K. Widjaja, Sing S. Liow, Subramanian S. Venkatraman & Marc J.M. Abadie – Accepted for publication in Polymer Degradation and Stability (2010)

**371 - Influence of structure of biodegradable triblock polymer PLA-(PCL-co-PLA)-PLA on mechanical properties.**

Vitali T. Lipik, Subbu S. Venkatraman and Marc J.M. Abadie  
Journal – Vysokomolekulyarnye soedineniya (VMS) (In Russian)- Polymer Chemistry: Series A (In English) Will be published in November 2010 (Number 10).

**372 - Thermoplastic biodegradable elastomers based on  $\epsilon$ -caprolactone and l-lactide block co-polymers: A new synthetic approach.** Vitali T. Lipik, Jen Fong Kong, Sujay Chattopadhyay, Leonardus K. Widjaja, Sing S. Liow, Subbu S. Venkatraman, Marc J.M. Abadie. / Acta Biomaterialia In Press, Corrected Proof, Available online 1 June 2010

**373 - Optimization of Synthesis of Poly( $\epsilon$ -caprolactone) by Ring Opening Polymerization.** Vitali Lipik, Marc J.M. Abadie

Iranian Polymer Journal, Submitted (2010)

# COURSE VENUE

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**CONTACT:**

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Dr Teresa Mata

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[tmata@fe.up.pt](mailto:tmata@fe.up.pt)

**NOTE:** this course is limited to a small number of participants, reserve your place soon!

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