



78th IUVSTA Workshop

New horizons in oxynitride thin films: from synthesis to applications

5-9 October, INL (Braga, Portugal)

WORKSHOP REPORT

I. INTRODUCTION

The 78th IUVSTA workshop was held in the International Iberian Nanotechnology Laboratory (INL) premises, from October 5 to 9, 2015 in Braga – Portugal. The participants were accommodated in Bom Jesus Hotels. The workshop attracted 52 attendees from 14 countries.

The aim of the 78th IUVSTA workshop on “New horizons in oxynitride thin films: from synthesis to applications”, was focused on the design, synthesis, properties, including the defect structure and applications, of several different types of oxynitride protective and functional thin films and coatings.

Multifunctional stable and metastable oxynitride coatings are an important field within thin films and coatings since they are expected to fill a gap between common properties of nitride and oxide based coatings. Therefore, oxynitrides are being considered to be of unique interest in fundamental research, but also for several industrial sectors. This was clearly presented and discussed in the workshop.

Several topics related with production, characterization and application of oxynitride thin films and coatings were in the main focus of the workshop. Invited talks given by renowned speakers from leading international groups, as well as some contributed posters presented the latest trends and results within this area of knowledge. With the topics chosen and the presence of attendees from the different areas of oxynitride research and neighboring fields, the 78th IUVSTA Workshop on “New horizons in oxynitride thin films: from synthesis to applications” revealed to be an important forum for inspiring international and interdisciplinary exchange between the participants.



The workshop provided breeding grounds and acted as a catalyst for novel approaches beyond traditional disciplines and cooperation between research groups and industrial end-users.

II. SCIENTIFIC CONTENT

In terms of the scientific event itself, the workshop was composed of 4 main parts:

- 1) *Nucleation and growth of thin films.*
- 2) *Preparation and characterization of Oxynitrides, divided into 3 sections:*
 - a. Overview of oxynitrides and plasma processes;
 - b. Modeling and optimization of reactive sputter deposition;
 - c. Thin films characterization.
- 3) *Properties and applications of Oxynitrides, divided into 3 sections:*
 - a. Transfer of scientific research to applications and industry;
 - b. Industrial applications;
 - c. Functional properties of oxynitrides.
4. *Special session on properties and applications of Oxynitrides* (for junior researchers).

Regarding the first part related with “nucleation and growth of thin films”, there was an invited talk given by I. Petrov, which gave a detailed overview about the Microstructure Evolution in PVD Coatings. This was a comprehensive analysis of different microstructural features that are related with the growth of thin films, namely oxynitrides.

The talks of part 2 were related with “Preparation and Characterization of Oxynitrides”, where we had 2 communications given by E. Wagenaars and J. Patscheider, focused on the plasma characterization and the effect of adding oxygen to common nitride thin films. The conjugation of these 2 talks enabled the audience to have a clear picture on the main points related with the growth of oxynitrides, namely in what concerns to the atomic species present in the plasma and, consequently, in the growing thin films.

These first 2 communications were then followed by a round table that allowed a deep analysis on Project applications within the frame of Horizon 2020 framework program, composed of an initial overview of application opportunities and the



discussion about specific points related with project application in European level and collaboration possibilities with countries out of the European space.

Part 2 of the workshop continued with “Modeling and Optimization of Reactive Sputter Deposition”. The three lecturers were D. Depla, which focused his talk on the theoretical and modeling part, as well as N. Martin and E. Tomasella, which gave further insights on the optimization and control of the reactive sputtering process for producing oxynitrides.

To finalize the part 2 of the workshop, the lectures from P. Berger and M.C.M de Lucas were related to oxynitride thin films characterization.

The “special session on properties and applications of oxynitrides” included the participation of five selected talks, where junior researchers (I. Heras, N. Schalk, M. Hans, J. Houska and D. Venkateshwarlu) presented the latest trends and results within this area of knowledge.

The workshop continued with part 3, related with “Properties and Applications of Oxynitrides”. It started with the perspective of leading scientists about the “Transfer of Scientific Research to Applications and Industry”. The lectures were given by J. Schmitz, J.V. Yakhmi and J.M. Schneider. The workshop continued with two lectures related with “Industrial Applications” of oxynitrides, where the point of view of two speakers from two companies was presented, namely M. Morstein and R.J.D. Alexandre.

The mention sessions were then followed by a Round Table about “Thin films in Industry” where scientists and company representatives discussed with the audience the major constraints of transferring the scientific knowledge and research to industry and, ultimately, to the market. This round table started with a case study brought by a Portuguese science-based incubator institution which set the tone to begin the discussion.

The part 3 of the workshop finished with the lecture of M. Fenker and J.-H Huang which presented some important works about the “functional properties of oxynitrides”, namely how this ternary system affects the corrosion resistance and mechanical properties of the materials.



III. FINANCIAL REPORT

Fees and number of participants of the 78th IUVSTA Workshop (Portugal, 2015),

Details	#	EUR
Organizing Committee	5	
Invited speakers	16	
Delegates	28	
Accompanying person	2	
Days of workshop	5	
Workshop fee		700.00 €
Workshop fee students without hotel and dinner		300.00 €
Accompanying person		400.00 €
Hotel (per night and person)		50.00 €
Lunch and coffee brakes at INL (per person)		10.00 €
Dinner at hotel Restaurant (per person)		18.00 €

BUDGET for IUVSTA Workshop,

Income	#	Unit	Sub-Total
IUVSTA funds	1		6 000.00 €
Workshop fee	14	700.00 €	9 800.00 €
Workshop fee students without hotel and dinner	2	300.00 €	600.00 €
Accompanying person	1	400.00 €	400.00 €
TOTAL			16 800.00 €

EXPENDITURE of the workshop,

Hotel**** (Invited speakers)			
Details	#	Unit	Sub-Total
03/out	1	70.00 €	70.00 €
	2	52.00 €	104.00 €
04/out	2	68.00 €	136.00 €
	12	50.00 €	600.00 €
05/out	2	68.00 €	136.00 €
	12	50.00 €	600.00 €
06/out	2	68.00 €	136.00 €
	13	50.00 €	650.00 €
07/out	2	68.00 €	136.00 €
	12	50.00 €	600.00 €
08/out	2	68.00 €	136.00 €
	10	50.00 €	500.00 €
09/out	1	50.00 €	50.00 €
TOTAL			3 854.00 €



Hotel*** (Delegates)			
Details	#	Unit	Sub-Total
04/out	1	44.00 €	44.00 €
	11	38.50 €	423.50 €
05/out	1	44.00 €	44.00 €
	11	38.50 €	423.50 €
06/out	1	44.00 €	44.00 €
	11	38.50 €	423.50 €
07/out	1	44.00 €	44.00 €
	10	38.50 €	385.00 €
08/out	10	38.50 €	385.00 €
TOTAL			2 216.50€

Dinner at Hotel			
Details	#	Unit	Sub-Total
03/out	2	18.00 €	36.00 €
04/out	32	18.00 €	576.00 €
05/out	35	18.00 €	630.00 €
06/out	40	18.00 €	720.00 €
07/out	36	18.00 €	648.00 €
TOTAL			2 610.00€

Lunch/coffee at INL			
Details	#	Unit	Sub-Total
04/out	43	10.00 €	430.00 €
05/out	44	10.00 €	440.00 €
06/out	44	10.00 €	440.00 €
07/out	44	10.00 €	440.00 €
Verde Honra	43	2.25 €	96.75 €
TOTAL			1 846.75 €

Transport and social day			
Details	#	Unit	Sub-Total
Excursion	1		400.00 €
Bus	1		600.00 €
Gala Dinner	41	35.00 €	1 435.00 €
TOTAL			2435.00 €



Other expenses with workshop			
Tuna	1		250.00 €
Program and abstract book	52		422.39 €
Badge holders	52		250.00 €
Flyer	52		300.00 €
Website and graphic design of the workshop	1		2 360.00 €
TOTAL			3582.39 €

Balance of the 78th IUVSTA Workshop,

Details	#	Income	Expenditure
IUVSTA funds	1	6 000.00 €	
Workshop fees	15	10 800.00 €	
Invited speakers	16		6 830.00 €
Delegates	14		5 409.50 €
Accompanying person	2		615.00 €
Organization/INL staff	5		107.25 €
Other expenses with workshop			3 582.39 €
Total		16 800.00 €	16 544.14 €
Balance		+ 255.86 €	



IV. WORKSHOP ORGANIZATION

Organization

Chairman: Filipe Vaz (University of Minho, Portugal)

Co-Chair: Lars Montelius (Director General INL, Portugal)

Organizing Committee

Filipe Vaz (University of Minho, Portugal)

Vasco Teixeira (University of Minho, Portugal)

Diederik Depla (Ghent University, Department of Solid State Sciences, Belgium)

Jochen M. Schneider ((RWTH Aachen Univeristy, Germany)

Lars Montelius Lars Montelius (Director General INL, Portugal)

Scientific Committee

Nicolas Martin (Institut FEMTO-ST, Besançon, France)

Martin Fenker (FEM, Schwäbisch Gmünd, Germany)

Tomas Polcar (Southampton University, UK)

Tomas Kubart (Uppsala University, Sweden)

Albano Cavaleiro (University of Coimbra, Portugal)

Luís Silvino Marques (University of Minho, Portugal)

Joaquim Carneiro (University of Minho – Portugal)

Euclides Luís (Instituto Superior Politécnico de Tecnologias e Ciências, Angola)

Pedro Alpuim (University of Minho and INL, Portugal)

Local Organizing Committee (University of Minho)

Filipe Vaz, Joel Borges, Armando Ferreira, Cláudia Lopes and Marco Rodrigues

Collaboration Partners

Albano Cavaleiro (University of Coimbra, Portugal)

Luís Cunha, Carlos Tavares, Pedro Alpuim, Diogo Costa, Mónica Vieira, João Pedro Fernandes
(University of Minho, Portugal)



V. INVITED SPEAKERS (in presentation order)

Ivan Petrov (University of Illinois, USA and Linköping University, Sweden): Microstructure evolution in PVD coatings

Jörg Patschneider (EMPA, Switzerland): Adding oxygen to metal nitrides: wandering in the concentration fields of oxynitrides

Erik Wagenaars (York Plasma Institute, University of York, UK): Plasma physics behind oxynitride film deposition

Diederik Depla (Ghent University, Department of Solid State Sciences, Research group DRAFT, Belgium): What can we learn from modelling of reactive magnetron sputtering?

Nicolas Martin (FEMTO-ST Institute, France): Gas pulsing for tunable oxynitride thin films

Eric Tomasella (ICCF UMR CNRS 6296, France): Oxynitride thin films deposited by reactive sputtering: process control and optimization to achieve applications in optical field

Pascal Berger (CNRS-CEA UMR NIMBE, France): Ion beam analysis of light elements in thin films: common uses and capabilities

Maria del Carmen Marco de Lucas (Laboratoire Interdisciplinaire Carnot de Bourgogne (ICB), UMR 6303 CNRS-Univ. Bourgogne Franche-Comté, France): Physicochemical characterization of titanium oxynitride thin films: a multi-technique approach

Jurrian Schmitz (University of Twente, Netherlands): Low temperature silicon oxynitride films for microelectronics

Jatinder Vir Yakhmi (Homi Bhabha National Institute, India): Unconventional and Hard Superconductivity in Si-doped Nb-oxynitride, compared to pure and Al-, and Mg-doped Nb-oxynitrides

Joachen Schneider (RWTH Aachen University, Germany): Quantum mechanically guided materials design approaches for industrial applications: Nitride, Oxynitride and Boroncarbide Coatings

Marcus Morstein (PLATIT AG): Structure and high-temperature wear properties of Al-Cr-based oxynitride coatings deposited by PVD

Ricardo J.D. Alexandre (TEandM, SA, Portugal): On the path of coating development for industrial applications: from research to market

Martin Fenker (FEM, Schwäbisch Gmünd, Germany): Do oxynitride coatings offer a good corrosion protection for steel substrates?

Jia-Hong Huang (National Tsing Hua University, Taiwan): Effect of oxygen on the fracture toughness of Zr(N,O) hard coatings



VI. INVITED PARTICIPANTS (others)

Opening Session and IUVSTA presentation (Monday, 5th October)

Filipe Vaz (Chairman and Pro-Rector of the University of Minho, Portugal)

Ricardo Rio (Mayor of the city of Braga)

Lars Montelius (Co-Chair and Director General INL, Portugal)

Ivan Petrov (Chair of the Surface Engineering Division of IUVSTA)

Nuno Peres (Director of the Centre of Physics of University of Minho, Portugal)

Round Table I (Monday, 5th October)

Ana Manaia (Instituto Pedro Nunes, Coimbra, Portugal)

Sofia Azevedo (GPPQ - Gabinete de Promoção do Programa Quadro de IDT da UE | Portuguese Framework Promotion Office)

Albano Cavaleiro (University of Coimbra, Portugal)

***Jörg Patschneider** (EMPA, Switzerland)

***Joachen Schneider** (RWTH Aachen University, Germany)

***Jurrian Schmitz** (University of Twente, Netherlands)

Round Table II (Wednesday, 7th October)

Filipe Vaz (University of Minho, Portugal)

Paulo Santos (Instituto Pedro Nunes, Coimbra, Portugal)

***Marcus Morstein** (PLATIT AG)

***Ricardo J.D. Alexandre** (TEandM, SA, Portugal)

S. Lanceros-Méndez (University of Minho, Portugal)

Peter Polcik (Plansee Composite Materials, Germany)

Laurent Espitalier (Wallwork Cambridge, UK)

After Dinner Sessions

Monday, 5th October: **António Manuel Portela de Sá Pereira** (University of Minho, Portugal):

History of Braga

Tuesday, 6th October: **Lars Montelius** (Director General INL, Portugal): *Overview of INL*

history and research fields

Wednesday, 7th October: **Nuno Peres** (Centre of Physics of University of Minho, Portugal):

Plasmonic effects in graphene in the THz

*Invited Speakers



VII. PROGRAM

Hour	Monday, 5 th October	Tuesday, 6 th October	Wednesday, 7 th October	Thursday, 8 th October	Friday, 9 th October
09:00 - 10:00	Welcome and Reception at INL	Lecture 4 D. Depla	Lecture 9 J. Schmitz	Lecture 14 M. Fenker	Visit to INL Facilities
10:00 - 10:30		Lecture 5 N. Martin	Lecture 10 J.V. Yakhmi	Lecture 15 J.-H. Huang	
10:30 - 11:00	Opening Session and IUVESTA Presentation	Coffee break	Coffee break	Coffee break	
11:00 - 11:30		Coffee break	Coffee break	Coffee break	
11:30 - 12:30	Lecture 1 I. Petrov	Lecture 6 E. Tomasella	Lecture 11 J.M. Schneider	Poster Session	Workshop closing remarks and farewell
12:30 - 14:00	Lunch	Lunch	Lunch	Lunch	Lunch
14:00 - 15:00	Lecture 2 J. Patscheider	Lecture 7 P. Berger	Lecture 12 M. Morstein	Guided Tour in Guimarães	
15:00 - 16:00	Lecture 3 E. Wagenaars	Lecture 8 M. C. Marco de Lucas	Lecture 13 R.J.D. Alexandre		
16:00 - 16:30	Coffee break	Coffee break	Coffee break		
16:30 - 16:50	Round Table (H2020: Project application) Ana Manaia Sofia Azevedo J. Patscheider A. Cavaleiro J.M. Schneider J. Schmitz	Inv. attendee: I. Heras	Round Table (Thin Films in Industry) Filipe Vaz Paulo Santos M. Morstein R.J.D. Alexandre S. Lanceros-Méndez P. Polcik L. Espitalier		
16:50 - 17:10		Inv. attendee: N. Schalk			
17:10 - 17:30		Inv. attendee: M. Hans			
17:30 - 17:50		Inv. attendee: J. Houska			
17:50 - 18:10		Inv. attendee: D.Venkateshwarlu			
18:10 - 18:30					
18:30 - 19:00	Verde de Honra - Wine tasting				
19:00 - 20:00					
20:00 - 21:30	Dinner	Dinner	Dinner	Gala Dinner	
21:30 - 23:00	After dinner session I	After dinner session II	After dinner session III		



VIII. DETAILED PROGRAM

Monday, 5th October 2015

09:00	Welcome and Reception at INL
10:30	Opening Session and IUVESTA Presentation
11:30	A: Nucleation and Growth of thin films. (Chair: F. Vaz) <hr/> <u>I. Petrov</u> MICROSTRUCTURE EVOLUTION IN PVD COATINGS
12:30	Lunch
14:00	B.I: Preparation and characterization of Oxynitrides. Part I: Overview of oxynitrides and plasma processes. (Chairs: N. Martin and A. Cavaleiro) <hr/> <u>J. Patscheider</u> ADDING OXYGEN TO METAL NITRIDES: WANDERING IN THE CONCENTRATION FIELDS OF OXYNITRIDES
15:00	<u>E. Wagenaars</u> PLASMA PHYSICS BEHIND OXYNITRIDE FILM DEPOSITION
16:00	Coffee Break
16:30	Round Table (H2020: Project application) Ana Manaia (IPN) Sofia Azevedo (GPPQ) J. Patscheider A. Cavaleiro J.M. Schneider J. Schmitz
18:30	"Verde de Honra" - Wine tasting
20:00	Dinner
21:30	After Dinner Session



Tuesday, 6th October 2015

09:00	<p>B.II: Preparation and characterization of Oxynitrides. Part II: Modeling and optimization of reactive sputter deposition. (Chairs: <i>I. Petrov and P. Alpuim</i>)</p> <p style="text-align: center;"><u>D. Depla</u></p> <p style="text-align: center;">WHAT CAN WE LEARN FROM MODELLING OF REACTIVE MAGNETRON SPUTTERING?</p>
10:00	<p style="text-align: center;"><u>N. Martin</u></p> <p style="text-align: center;">GAS PULSING FOR TUNABLE OXYNITRIDE THIN FILMS</p>
11:00	<p>Coffee Break</p>
11:30	<p style="text-align: center;"><u>E. Tomasella</u></p> <p style="text-align: center;">OXYNITRIDE THIN FILMS DEPOSITED BY REACTIVE SPUTTERING: PROCESS CONTROL AND OPTIMIZATION TO ACHIEVE APPLICATIONS IN OPTICAL FIELD</p>
12:30	<p>Lunch</p>
14:00	<p>B.III: Preparation and characterization of Oxynitrides. Part III: Thin films characterization. (Chairs: <i>J.M. Schneider and E. Wagenaars</i>)</p> <p style="text-align: center;"><u>P. Berger</u></p> <p style="text-align: center;">ION BEAM ANALYSIS OF LIGHT ELEMENTS IN THIN FILMS: COMMON USES AND CAPABILITIES</p>
15:00	<p style="text-align: center;"><u>M.C.M. de Lucas</u></p> <p style="text-align: center;">PHYSICOCHEMICAL CHARACTERIZATION OF TITANIUM OXYNITRIDE THIN FILMS: A MULTI-TECHNIQUE APPROACH</p>
16:00	<p>Coffee Break</p>
16:30	<p>D: Special session on properties and applications of Oxynitrides. (Chairs: <i>J.V. Yakhmi and L. Marques</i>)</p>
16:30	<p><u>I. Heras</u>: Comprehensive real time characterization of AlTiO_xN_y thin films at high temperatures.</p>
16:50	<p><u>N. Schalk</u>: Microstructure, mechanical and optical properties of TiAlON coatings sputter deposited with varying oxygen partial pressures.</p>
17:10	<p><u>M. Hans</u>: Effect of oxygen incorporation on the structure and elasticity of Ti-Al-O-N coatings, synthesized by Cathodic Arc and High Power Pulsed Magnetron Sputtering.</p>
17:30	<p><u>J. Houska</u>: Tantalum oxynitride films with smoothly tunable composition, electronic structure and properties.</p>
17:50	<p><u>D. Venkateshwarlu</u>: Vortex Glass State in Si doped Niobium Oxy-nitride Superconductor.</p>
20:00	<p>Dinner</p>
21:30	<p>After Dinner Session</p>



Wednesday, 7th October 2015

09:00	<p>C.I: Properties and applications of Oxynitrides: Part I: Transfer of scientific research to applications and industry. (Chairs: <i>D. Depla and L. Cunha</i>) <u>J. Schmitz</u> LOW TEMPERATURE SILICON OXYNITRIDE FILMS FOR MICROELECTRONICS</p>
10:00	<p><u>J.V. Yakhmi</u> UNCONVENTIONAL AND HARD SUPERCONDUCTIVITY IN Si-DOPED Nb-OXYNITRIDE, COMPARED TO PURE AND Al-, AND Mg-DOPED Nb-OXYNITRIDES</p>
11:00	<p>Coffee Break</p>
11:30	<p><u>J.M. Schneider</u> QUANTUM MECHANICALLY GUIDED MATERIALS DESIGN APPROACHES FOR INDUSTRIAL APPLICATIONS: NITRIDE, OXYNITRIDE AND BORONCARBIDE COATINGS</p>
12:30	<p>Lunch</p>
14:00	<p>C.II: Properties and applications of Oxynitrides: Part II: Industrial applications. (Chairs: <i>M. Fenker and J.-H. Huang</i>) <u>M. Morstein</u> STRUCTURE AND HIGH-TEMPERATURE WEAR PROPERTIES OF Al-Cr-BASED OXYNITRIDE COATINGS DEPOSITED BY PVD</p>
15:00	<p><u>R.J.D. Alexandre</u> ON THE PATH OF COATING DEVELOPMENT FOR INDUSTRIAL APPLICATIONS: FROM RESEARCH TO MARKET</p>
16:00	<p>Coffee Break</p>
16:30	<p>Round Table (Thin Films in Industry) Filipe Vaz Paulo Santos M. Morstein R.J.D. Alexandre S. Lanceros-Méndez P. Polcik L. Espitalier</p>
20:00	<p>Dinner</p>
21:30	<p>After Dinner Session</p>



Thursday, 8th October 2015

09:00	<p>C.III: Properties and applications of Oxynitrides: Part III: Functional properties of oxynitrides. <i>(Chairs: E. Tomasella and P. Berger)</i></p> <hr style="border-top: 1px dotted black;"/> <p><u>M. Fenker</u></p> <p>DO OXYNITRIDE COATINGS OFFER A GOOD CORROSION PROTECTION FOR STEEL SUBSTRATES?</p> <hr style="border-top: 1px dotted black;"/>
10:00	<p><u>J.-H. Huang</u></p> <p>EFFECT OF OXYGEN ON THE FRACTURE TOUGHNESS OF Zr(N,O) HARD COATINGS</p>
11:00	<p>Coffee Break</p>
11:30	<p>Poster Session</p>
12:30	<p>Lunch</p>
14:00	<p>Guided Tour in Guimarães</p>
20:00	<p>Gala Dinner</p>

Friday, 9th October 2015

09:00	<p>Visit to INL Facilities</p>
11:00	<p>Coffee Break</p>
11:30	<p>Workshop closing remarks and farewell</p>
12:30	<p>Lunch</p>



IX. LIST OF ATTENDEES (in alphabetical order)

	Name	Affiliation
1	Albano Augusto Cavaleiro R Carvalho	University of Coimbra, Portugal
2	Alice Maria da Costa Marciel Trabulo	Aveiro University, Portugal
3	Ana Manaia	Intituto Pedro Nunes, Coimbra, Portugal
4	Armando José Barros Ferreira	University of Minho, Portugal
5	Catarina Oliveira	University of Minho, Portugal
6	Cláudia de Jesus Ribeiro Lopes	University of Minho, Portugal
7	Daniel Cristea	Transilvania University, Romania
8	Davide André Meneses Silva	University of Minho, Portugal
9	Diederik Depla	Ghent University, Belgium
10	Diogo Emanuel Carvalho Costa	University of Minho, Portugal
11	Dontula Venkateshwarlu	UGC-DAE, India
12	Eluxka Almandoz Sanchez	Asociacion Industria Navarra, Spain
13	Eric Tomasella	ICCF UMR CNRS, France
14	Erik Wagenaars	York Plasma Institute, UK
15	Fábio Emanuel de Sousa Ferreira	University of Coimbra, Portugal
16	Filipa Daniela Pereira Fernandes	University of Minho, Portugal
17	Irene Heras Pérez	Abengoa Research, Spain
18	Ivan Petrov	University of Illinois, USA
19	Jatinder Vir Yakhmi	Homi Bhabha National Institute, India
20	Jia-Hong Huang	National Tsing Hua University, Taiwan
21	Jiri Houska	University of West Bohemia, Czech Republic
22	João Pedro da Costa Fernandes	University of Minho, Portugal
23	Jochen M. Schneider	RWTH Aachen Univeristy, Germany
24	Joel Nuno Pinto Borges	University of Minho, Portugal
25	Jörg Patscheider	EMPA, Switzerland
26	José Filipe Vilela Vaz	University of Minho, Portugal
27	Jurriaan Schmitz	University of Twente, Netherlands
28	Konrad Fadenberger	Robert Bosch GmbH, Germany
29	Lars Montelius	INL, Portugal
30	Laurent ESPITALIER	Wallwork Cambridge, UK
31	Luís António Carvalho G. da Cunha	University of Minho, Portugal
32	Luis Silvino Marques	University of Minho, Portugal
33	Marco Pires Rodrigues	University of Minho, Portugal
34	Marcus Hans	RWTH Aachen University, Germany
35	Marcus Morstein	PLATIT AG
36	Maria del Carmen MARCO DE LUCAS	U. Bourgogne Franche-Comté, France
37	Maria Ruth Fischer	EMPA, Switzerland
38	Martin Fenker	FEM, Schwäbisch Gmünd, Germany
39	Mathis Trant	EMPA, Switzerland
40	Melkamu Awoke Mekicha	University of Coimbra, Portugal
41	Mónica Sofia Bastos Vieira	University of Minho, Portugal
42	Nicolas Martin	FEMTO-ST Institute, France
43	Nina Schalk	Montanuniversitat Leoben, Austria
44	Nuno Peres	University of Minho, Portugal
45	Pascal BERGER	CNRS-CEA UMR NIMBE, France
46	Paulo Jorge Marques dos Santos	Intituto Pedro Nunes, Coimbra, Portugal
47	Pedro Alpuim	INL, Portugal
48	Peter Polcik	Plansee Composite Materials, Germany
49	Ricardo Jorge David Alexandre	TEandM, SA, Portugal
50	Robert Hugon	Institut Jean Lamor, France
51	Senentxu Lanceros-Mendez	University of Minho, Portugal
52	Sofia Azevedo	GPPQ de IDT da EU, Portugal



X. GALLERY

