RNME - REDE NACIONAL DE MICROSCOPIA ELECTRÓNICA

NATIONAL ELECTRON MICROSCOPY NETWORK

RNME – Pole of Instituto Superior Técnico

TÉCNICO LISBOA

ICEMS
INSTITUTO DE CIÊNCIA E ENGENHARIA DE MATERIAIS E SUPERFÍCIES
INSTITUTE OF MATERIALS AND SURFACES SCIENCE AND ENGINEERING

MicroLab – Laboratório de Microscopia Electrónica

ACTIVITY REPORT

1st semester of 2013

1. Global characterization of the Pole activity and progress during the 1st semester of 2013

The MicroLab-Laboratory of Electron Microscopy is a state-of-the-art facility on IST campus whose mission is to provide high-end electron microscopy services. The laboratory is open for use by students, faculty and staff of IST or other universities and institutes, as well as commercial groups with a need for the analytical services the lab can provide.

During the first semester of 2013 the number of individual users of the MicroLab's facilities was 181 (not including visitors), distributed in 594h00 on the FEG-SEM JEOL JSM7001F, 297h00 on the SEM Hitachi S2400 and 303h00 on the TEM Hitachi H8100 II.

The number of users from companies is similar to the first half of 2012, with a total use of 52h00.

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2. Resources and operation conditions.

2.1.Material resources.

HR-SEM-SE/EDS: SEM (JEOL JSM-7001F) with elemental and diffraction pattern analysis (Oxford INCA 250)

Field Emission Gun Scanning Electron Microscope with Schottky (SE) emission, resolution of 1.2 nm at 15kV, equipped with secondary and backscattered electron detectors, and also with an Energy Dispersive Spectroscopy (EDS) light elements detector and a system for the detection and processing of electron backscattered diffraction patterns (EBSD).

SEM/EDS: SEM (Hitachi S-2400) with elemental analysis (Bruker)

Scanning Electron Microscope with thermionic (W) emission, resolution of 5nm at 25kV, equipped with secondary and backscattered electron detectors, with an Energy Dispersive Spectroscopy (EDS) detector, and also with digital image acquisition.

CTEM: TEM (Hitachi H-8100 II) with elemental analysis (Thermo Noran SystemSix)

Transmission Electron Microscope with thermionic emission (LaB6) and 200kV acceleration voltage, resolution of 2.7 Å point to point, equipped with an Energy Dispersive Spectroscopy (EDS) light elements detector and a double-tilt Gatan sample-holder for electron diffraction studies (sample tilts 90º in one direction and 60º on the normal direction). Digital image acquisition with a CCD MegaView II bottom-mounted camera.

High vacuum metal sputtering and carbon evaporation for FEG-SEM and TEM applications (Quorum Technologies Q150T ES).

Ion mill for TEM sample preparation (GatanDuomill 600F)

Dimpler for TEM sample preparation (South Bay Instruments D500i)

Optical microscope (Cole-Palmer) for support in sample preparation.

Desiccation chamber for sample storage (Pelco 2251).

2.2.Human resources supporting the experimental facilities operation.

Scientific and technical resources

Name	Degree	Contract Category	Function in the RNME	RNME (h/week)
Rui Vilar	PhD	Full Professor	MicroLab Supervisor	5
Amélia Almeida	PhD	Assistant Professor	Formation and scientific advisor	5
Patrícia Carvalho	PhD	Assistant Professor	Formation and scientific advisor	5
Isabel Nogueira	MsC	Technician	Sample preparation, FEG-SEM, SEM and TEM operator, maintenance	35

2.3.Rules and access conditions to the electron microscopy experimental facilities.

The MicroLab-Electron Microscope Laboratory is available for all undergraduates, graduates, professors and researchers in ICEMSas well asfrom other departments at Instituto Superior Técnico, other universities, institutes or commercial companies.

Our website is available through http://groups.ist.utl.pt/microlab/index.html

The facility is available both as a user-run facility for authorized independent users and as a service with technical help, through a web based booking system available at http:// groups.ist.utl.pt/microlab/scheduler.

MicroLab allows intensive users of the laboratory to become independent operators, allowing them to book the equipment off regular hours (e.g. before 9h00, after 17h00 and during weekends and holidays).

MicroLab has a full-time laboratory technician responsible for the operation of all equipment, maintenance, online booking and support to independent users.

User fees are listed on http://groups.ist.utl.pt/microlab/pdfs/tabela_2013.pdf.

3.Training activities.

3.1 Training, information and demonstration activities addressed to researchers and to other users of the RNME.

MicroLab has personalized training sessions for intensive users who wish to become independent operators of some of the equipment of the laboratory.

The schematics of such training is:

1. Theoretical introduction with full support from the lab technician;
2. Practical sessions with a minimum of 6 hours with full support from the lab technician;
3. Practical sessions with a minimum of 12 hours with supervision from the lab technician.

In particular cases this training can be adjusted either because the new operator has previous experience in similar equipment or because he/she needs more practice before being considered independent.

If the training is successful the lab technician will authorise the user to have access to the laboratory off working hours and to book the equipment online.

Training, information and demonstration activities

Training of equipment users/operators	Full Duration	Date	Participants
SEM Hitachi S2400	12h	8/1-11/1	Mafalda Guedes
SEM Hitachi S2400	12h	29/1-1/2	Marta Dias
SEM Hitachi S2400	12h	4/2-8/2	Laura Cordoba
SEM Hitachi S2400	6h	15/5-16/5	Darya Snihirova
SEM Hitachi S2400	6h	20/6-23/6	João Jeremias
FEG-SEM JEOL JSM7001F	8h	18/2-20/2	Pedro Nolasco
FEG-SEM JEOL JSM7001F	8h	4/3-6/3	Mafalda Guedes
FEG-SEM JEOL JSM7001F	8h	4/3-6/3	Laura Cordoba
FEG-SEM JEOL JSM7001F	16h	21/1-24/1	João Jeremias
FEG-SEM JEOL JSM7001F	10h	18/3-20/3	Liliana Cangueiro
FEG-SEM JEOL JSM7001F	15h	12/5-15/5	Maryna Taryba
TEM Hitachi H8100	18h	11/3-14/3	Tânia Ribeiro
TEM Hitachi H8100	20h	8/4-12/4	Catarina Santos
TEM Hitachi H8100	24h	18/2-22/2	João Silveira

3.2 Teaching, training, information and demonstration activities

In the frame of the University curricular activities

	Curricular units Course Discipline	Course Faculty / University
PhD course 3rd cycle	Materials Characterisation	Materials Engineering-IST
Master course 2nd cycle	Biomaterials II	Biomedical Engineering-IST
Master course 2nd cycle	Project in Bioengineering and Nanosystems	Bioengineering and Nanosystems-IST
Master course 2nd cycle	Project in Materials Engineering	Materials Engineering-IST

Study visits to the MicroLab

Date		Course Discipline	Course School/University	Students
10/5	Degree course 2nd cycle	Materials Science and Technology	Physics Engineering FCUL	10
13/5	Degree course 2nd cycle	Structure and Characterisation of Surfaces and Interfaces	Technological Chemistry FCUL	9
28/5-29/5	High School	Biology	10th and 11th grades Colégio Sagrado Coração de Maria	52

FCUL-Faculdade de Ciências da Universidade de Lisboa
IST-Instituto Superior Técnico

4. Electron Microscopy service activity and collaboration in research and development projects

4.1 Electron Microscopy service activity

Instrument: FEG-SEM JEOL JSM7001F

User Class Application	Number Of Users	Number of Work Sessions	Number of Hours
Visitors	19	2	3h00
Classes	34	6	20h00
Training activities	6	30	65h00
Courses	0	0	0h00
Teachers / Researchers (PhD)	34	94	140h00
Researchers (PhD) (under Research Grant contract)	17	68	75h00
PhD Students	30	160	210h00
MSc Students	16	48	51h00
Public and private companies (Industry and Services)	5	34	30h00
TOTAL	**161**	**442**	**594h00**

Duration (working hours)	Description	Ineffectiveness	Downtime (working hours)
12:00	Scheduled power cuts	100%	12:00
20:00	Minor repairs or calibrations	100%	20:00
770:00	Operative but without specimen exchange chamber (4/2 to 30/6/2013)	40%	308:00
12:00	Maintenance	100%	12:00
		TOTAL:	**352:00**

Since the 4th of February the FEG-SEM has a serious mal-function in its specimen exchange chamber. This mal-function causes the specimen exchange time to be extremely high (around 1h00, depending on samples), increasing the waiting time between sessions.

The FEG-SEM had a total use of approximately 594h00, from 448h00 possible during work hours (800 – 352h00). This means that it was operated off working hours more than usual, as a direct consequence of its malfunction. Also because of this problem the average duration of each session has decreased to 1h15.

Downtimes of this instrument due to maintenance had a small contribution to the total downtime, which was mostly due to the malfunction on the specimen exchange chamber.

Instrument: SEM Hitachi S2400

User Class Application	Number of Users	Number of Work Sessions	Number of Hours
Visitors	52	5	6h00
Classes	1	1	2h30
Training activities	5	26	48h00
Courses	0	0	0h00
Teachers / Researchers (PhD)	25	36	66h00
Researchers (PhD) (under Research Grant contract)	4	11	25h00
PhD Students	16	51	78h00
MSc Students	13	34	52h00
Public and private companies (Industry and Services)	2	9	22h00
TOTAL	**118**	**173**	**297h00**

Duration (working hours)	Description	Ineffectiveness	Downtime (working hours)
12:00	Scheduled power cuts	100%	12:00
10:00	W filament exchange	100%	10:00
12:00	Scheduled maintenance	100%	12:00
		TOTAL:	**34:00**

The SEM had a total use of 297h00, from a total of 766h00 possible (800 – 34h00). It corresponds to 40% usage time with an average session duration of approximately 1h45.

Instrument: TEM Hitachi H8100II

User Class Application	Number of Users	Number of Work Sessions	Number of Hours
Visitors	71	7	7h00
Classes	34	6	20h00
Training activities	3	2	62h00
Courses	0	0	0h00
Teachers / Researchers (PhD)	20	39	76h00
Researchers (PhD) (under Research Grant contract)	10	27	35h00
PhD Students	23	41	94h00
MSc Students	2	5	9h00
Public and private companies (Industry and Services)	0	0	0h00
TOTAL	**163**	**127**	**303h00**

Duration (working hours)	Description	Ineffectiveness	Downtime (working hours)
12:00	Scheduled power cuts	100%	12:00
28:00	LaB6 filament exchange and adjustments	100%	28:00
10:00	Minor repairs and calibrations	100%	10:00
12:00	Scheduled maintenance	100%	12:00
75:00	Compressed air tubes and/or valve leak	100%	75:00
		TOTAL:	**137:00**

The TEM had a use of 303 hours, from a total of 663 hours possible (800 – 137 hours). This means that the microscope had 46% usage time with an average session of 2h15.

The main problems occurring with this instrument are due to its life span, namely the recurrent leaks in air compressed tubes, which are often difficult to repair because of their location inside the microscope column.

Users List

Teachers / Researchers (PhD)	Department Faculty	University Institution	SEM S2400	FEG-SEM 7001F	TEM H8100
Ana Paula Soares	ICEMS	IST		X	X
Fátima Vaz	ICEMS	IST	X		
Luís Reis	ICEMS	IST	X		
Virgínia Infante	ICEMS	IST	X	X	
Manuel Freitas	ICEMS	IST	X	X	
Sousa Brito	ICEMS	IST	X		
Reinhard Schwarz	ICEMS	IST		X	
Patrícia Carvalho	ICEMS	IST	X	X	X
Amélia Almeida	ICEMS	IST	X	X	X
Luis Santos	ICEMS	IST			X
Vitor Oliveira	ICEMS	ISEL	X	X	
António Silvestre	ICEMS	ISEL			X
Mafalda Guedes	ICEMS	EST-IPS	X	X	
Rui Martins	ICEMS	EST-IPS	X		
Alexandra Rodrigues	ICEMS	EST-IPS		X	
João Salvador	ICEMS	IST		X	
Fátima Montemor	ICEMS	IST		X	X
Clara Gonçalves	ICEMS	IST		X	X
Olinda Conde	ICEMS	FCUL		X	
Rafaela Cardoso	Civil	IST	X		
Amélia Dionísio	Minas	IST	X	X	
Fernanda Margarido	Mecânica	IST	X		
Correia Diogo	Mecânica	IST	X		
Rogério Colaço	Química	IST	X	X	
Frederico Ferreira	Química	IST	X		
Gomes de Azevedo	Química	IST		X	
Carlos Baleizão	Química	IST	X	X	X

Miguel Prazeres	Química	IST		X	
Manuela Lopes	-	Medicina Dentária		X	X
Carla Costa	Civil	ISEL		X	
Luísa Jordão	-	IHMT	X	X	X
Lídia Gonçalves	-	Fac. Farmácia		X	X
Teresa Casimiro	Química	FCT-UNL		X	
Luísa Neves	Química	FCT-UNL		X	
Isabel Ferreira	Física	FCT-UNL			X
Ana Nunes	Química	FCT-UNL		X	
Agnés Le Gac	Cons. e Restauro	FCT-UNL		X	
Magdalena Kowacz	-	ITQB		X	
Helena Pereira	Eng. Florestal	ISA	X		
Isabel Miranda	Eng. Florestal	ISA	X		
Anabela Boavida	Química	FCUL		X	
Maria de Deus Carvalho	Química	FCUL			X
Olinda Monteiro	Química	FCUL		X	X
Ana Paula Carvalho	Química	FCUL			X
Inês Fonseca	Química	FCUL	X	X	
Maria Estrela Jorge	Química	FCUL		X	
Cristina Oliveira	Química	UTAD			X
Angela Nunes	Química	ISEL			X
Ana Paula Serro	-	ISCSEM		X	
António Gonçalves	ITN	IST	X		
Odila Florêncio			X	X	
Filipe Freire	Química	IST	X		
Catarina Santos	ICEMS	EST-IPS	X	X	X
Teresa Gasche	-	LNEG			X
Susana Andrade	Química	IST			X

Researchers (PhD) (under Research Grant contract)	Department Faculty	University Institution	SEM S2400	FEG-SEM 7001F	TEM H8100
Huibin Xue	ICEMS	IST		X	
Luís Fortes	ICEMS	IST			X
Rachid Ayouchi	ICEMS	IST		X	
Sharma Sahendra	ICEMS	IST	X	X	X
Maryna Taryba	ICEMS	IST		X	
Auguste Fernandes	Química	IST		X	
Miguel Rodrigues	Química	IST		X	
Ana Miller	Minas	IST		X	
Marta Dias	ITN	IST	X	X	
Carlos Bueno	Química	IST			X
Rodrigo Mateus	IPFN	IST		X	
Teresa Cesário	Química	IST		X	X
Pedro Quaresma	-	Univ. Porto			X
José Condeço	Química	IST		X	
Manoj Gawande	Química	FCT-UNL		X	X
Pedro Vaz	Química	FCUL		X	X
Carla Nunes	Química	FCUL		X	X
Daniela Nunes	Química	FCT		X	X
Sónia Eugénio	ICEMS	IST	X	X	X
Darya Snihirova	ICEMS	IST	X	X	

PhD Students	Department Faculty	University Institution	SEM S2400	FEG-SEM 7001F	TEM H8100
Amir Zomoridian	ICEMS	IST	X	X	
Yegor Mozorov	ICEMS	IST		X	
Ricardo Pinto	ICEMS	IST		X	

Artur Bento	ICEMS	IST		X	X
Pedro Nolasco	ICEMS	IST	X	X	X
Bruno Nunes	Química	IST	X	X	
Tomin Liu	ICEMS	IST	X	X	X
Carole Loable	ICEMS	IST	X	X	
Alexandre Cunha	ICEMS	IST	X		
Catarina Vidal	Mecânica	IST		X	
Ulisses Fernandes	Mecânica	IST		X	
Patrizia Paradiso	Mecânica	IST	X	X	
Rodrigo Santos	Química	IST	X		
Luís Lopes	Química	IST		X	X
Tânia Ribeiro	Química	IST			X
Sofia Martins	Química	IST		X	X
Ana Sofia Rodrigues	Química	IST			X
Catarina Santos	Química	IST		X	X
Raja Sebastian	Química	IST		X	X
Cristina Neves	-	Univ. Porto			X
Telma Barroso	Química	FCT-UNL		X	
Renato Cabral	Química	FCT-UNL		X	X
Sofia Silva	Química	FCT-UNL			X
Cláudia Correia	Química	FCT-UNL		X	
Anita Lourenço	Química	FCT-UNL			X
João Conde	Química	FCT-UNL			X
Francisco Silva	ITN	IST			X
Inês Graça	Química	IST			X
Joana Marto	-	Fac. Farmácia			X
João Silveira	Eng. Florestal	ISA			X

Umut Sen	Eng. Florestal	ISA	X		
Daniel Siopa	Química	FCUL		X	
Tânia Frade	Química	FCUL		X	
Cristina Fernandes	Química	FCUL		X	X
Ana Mestre	Química	FCUL		X	X
Daniel Deodato	-	ITQB		X	
Vanessa Gonçalves	-	ITQB		X	
Helga Garcia	-	ITQB		X	
Margarida Rodrigues	ITN	IST	X	X	
Laura Cordoba	Química	IST	X	X	X
Raquel Bértolo	Química	IST		X	
João Diogo	Química	IST	X		
Sofia Panão	Química	IST	X	X	
Tuyen Nguyen	Química	IST	X	X	X
Catarina Vale	Mecânica	IST	X		
Giuliana Mancini	-	Fac. Farmácia			X
Lília Alexandre	Química	IST	X		

MSc Students or with Research Grant	**Department Faculty**	**University Institution**	**SEM S2400**	**FEG-SEM 7001F**	**TEM H8100**
Joana Matos	ICEMS	IST			X
Ivan Rodrigues	ICEMS	IST	X		
Rute Caetano	Química	IST	X		
Mirela Lourenço	ICEMS	IST	X	X	
Catarina Duarte	ICEMS	FCUL		X	
Elisabeth Payrer	ICEMS	IST		X	
Ana Santiago	Química	IST			X

Ana Anjos	ICEMS	IST	X	X	
Raquel Flores	ICEMS	FCUL		X	
Liliana Cangueiro	Química	IST	X	X	
Ana Santo	Química	IST		X	
Ana Ferreira	Química	IST		X	
Tatiana Sirgado	Química	IST	X		
Inês Ferreira	Química	IST	X		
Rita Pais	Química	IST		X	
Martim Teixeira	Química	IST	X		
Sofia Panão	Química	IST	X		
Vanessa Correia	Química	FCT		X	
Elena Niculita	Química	FCUL		X	
Sara Casado	-	Coop. Egas Moniz		X	
Inês Laginha	Civil	ISEL		X	
Cátia Santos	Civil	ISEL		X	
Hugo Andrade	-	IBET		X	
Ramana Venkata	Química	IST	X		
João Jeremias	Química	IST	X	X	
Ana Matias	Química	IST	X		
João Vicente	Química	IST	X		

Coop. Egas Moniz-Cooperativa de ensino Engas Moniz
EST-IPS-Escola Superior de Tecnologia do Instituto Politécnico de Setúbal
FCT-UNL-Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa
FCUL-Faculdade de Ciências da Universidade de Lisboa
ICEMS-Instituto de Ciência e Engenharia de Superfícies
IHMT-Instituto de Higiene e Medicina Tropical
ISA-Instituto Superior de Agronomia
ISCSEM-Instituto Superior de Ciências da Saúde Egas Moniz
ISEL-Instituto Superior de Engenharia de Lisboa
IST-Instituto Superior Técnico
ITQB-Instituto de Tecnologia Química e Biológica
LNEG – Laboratório Nacional de Energia e Geologia
UTAD-Universidade de Trás-os-Montes e Alto Douro

Public and private companies (Industry and Services)	SEM S2400	FEG-SEM 7001F	TEM H8100
YD Ynvisible SA		X	
Hovione FarmaCiência SA	X	X	
Susana Dias (dentista)		X	
Isabel Vasconcelos (dentista)		X	
GALP Energia	X		
CIMPOR		X	

ANNEX 1

SEM

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