

ENGINEERING

MULTI-USER EQUIPMENT

ADVANCED TECHNOLOGY TO
REACH OF RESEARCHERS

Engineering

ACQUISITION OF CRYOGEN-FREE EQUIPMENT FOR THE CHARACTERIZATION OF MAGNETIC PROPERTIES BY VIBRATING SAMPLE MAGNETOMETRY

Carlos Alberto Moreira dos Santos

Lorena School of Engineering
University of São Paulo (USP)
FAPESP Grant 2009/54001-2

The objective of this proposal is the acquisition of a cryogenic-free system for the measurement of magnetization and of other physical properties, which will eliminate the need for the frequent procurement of liquid helium. The acquisition of this system will resolve the problem of magnetic properties measurement that the Superconductivity Group of the Department of Materials Engineering of the USP School of Engineering at Lorena has faced for more than ten years. Among the relevant scientific aspects of the various associated and complementary projects, the use of magnetic measurements plays an important role in the following activities: i) the investigation of new superconducting materials; ii) the study of the quasi-unidimensional structure of molybdates; iii) the study of magnetostriction in iron-based alloys; iv) the study of magnetic superlattices and quantum structures; v) the study of polymers with magnetic inclusion compounds; vi) the study of the dynamics of vortices and the optimization of flux trapping in superconductors; and vii) the study of the magnetic properties of various materials. The team includes 19 researchers involved in the associated and complementary projects underway at renowned teaching institutions and research institutes in the Vale do Paraíba region. All of the researchers in the group are intensely involved in scientific activity, the great majority being recipients of Productivity in Research grants from the National Council for Scientific and Technological Development (CNPq), and maintain active, significant international affiliations. In addition, they are advisors to a number of young investigators and graduate students. Our Department has the infrastructure and technical staff necessary for the installation and maintenance of the equipment requested by the FAPESP Multi-User Equipment Program.

EQUIPMENT GRANTED

- PPMS 9 Base System, p525 Vibrating Sample Magnetometer, and P960 Helium Reliquefier (Quantum Design)
- “Chiller” Refrigerator (Mecalor Soluções em Engenharia Térmica Ltda.)

ASSOCIATED PROJECTS

Lorena School of Engineering/USP

Using strong magnetic fields at low temperatures to research novel materials

Nei Fernandes de Oliveira Junior
FAPESP Grant 2007/50968-0

Physical properties of monocrystals with low dimensionality

Carlos Alberto Moreira dos Santos
FAPESP Grant 2007/04572-8

Investigation and coexistence of magnetism and superconductivity in novel interstitial alloys of the Fe-Se-X and Mg-Ce-X systems

Ausdinir Danilo Bortolozo
FAPESP Grant 2009/00610-8

Microstructural and superconductor characterization of Nb₃Sn wire reinforced with CuNb

Maria José Ramos
FAPESP Grant 2006/61753-2

Study of magnetostriction in Fe-X and Co-Y alloys, where X and Y are non-magnetic elements

Cristina Bormio Nunes
FAPESP Grant 2008/07463-8

Optimization of intragranular and intergranular flux trapping in MgB₂ superconductors by high-energy milling with AlB₂, carbon, SiC, and boron nitride compounds

Durval Rodrigues Junior
CNPq

Preparation and characterization of MgB₂ superconductor wires and tapes prepared by the powder-in-tube [PIT] method

Durval Rodrigues Junior
Capes

Investigation of superconductivity in hexagonal carbides of the family M₂AX

Antonio Jefferson da Silva Machado
FAPESP Grant 2005/01257-9

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ACQUISITION OF AN X-RAY FLUORESCENCE SPECTROMETER FOR THE ELEMENTAL CHEMICAL CHARACTERIZATION OF METALS, CERAMICS, POLYMERS AND RESIDUES OF INDUSTRIAL ACTIVITIES

Carlos Ângelo Nunes

Lorena School of Engineering

University of São Paulo (USP)

FAPESP Grant 2009/54118-7

Materials research involves the microstructural and elemental analysis of new materials and the development of options related to existing ones. Chemical and elemental characterization is crucial to monitoring the production of materials, ensuring their quality, and identifying components that potentially enhance or detract from the projected properties. The Department of Materials Engineering of the USP Lorena School of Engineering (EEL) has an extensive research program, demanding analytical techniques that are rapid, precise, and accurate and that allow the determination of major and trace elements. Our objectives in requesting the equipment listed below are to meet the needs of the associated and complementary projects, as well as those of other projects organized by the EEL and by its partner institutions that develop large research projects in collaboration with entities such as Petrobras (Inpe, Cachoeira Paulista; catalysts), Embrapa Forestry Division (USP/EEL; biomass derivatives for thermoelectric energy generation), the CSN (USP/EEL; development and characterization of refractory materials and re-use of residues for metallurgy). There is also a demand within the Vale do Paraíba region (in the State of São Paulo), as well as in the southern portions of the states of Rio de Janeiro and Minas Gerais, to analyze and identify minerals, environmental changes, and materials to be developed in Brazil based on materials that are currently imported. This demand is not being fully met, because the X-ray fluorescence equipment that exists belongs to the companies and are limited in their configuration. Greater availability of such equipment will increase opportunities for the training of staff in the technique and should motivate the initiation of new lines of research based on the re-use of industrial residues. The equipment requested

EQUIPMENT GRANTED

- Axios X-ray fluorescence spectrometer and accessories – set of 7 crystals, tube and mask set (PANalytical B.V.)
- Semi-automatic hydraulic press (Herzog GmbH)
- HP-M 100P oscillating-disk pulverizer (Herzog GmbH)
- HA-HF16 four-position automatic fusion machine (Herzog GmbH)

is a sequential wavelength dispersive X-ray fluorescence spectrometer that provides great analytical versatility, through the use of different crystals and detectors, as well as having good sensitivity and low detection limits for the determination of light metals.

ASSOCIATED PROJECTS

Lorena School of Engineering/USP

Experimental study of the Hf-Si-B system

Carlos Angelo Nunes

FAPESP Grant 2007/05206-5

Study of the behavior, during fluence, of the alloy Ti-6Al-4V submitted to plasma-assisted thermochemical treatment

Miguel Justino Barbosa

FAPESP Grant 2007/54987-0

Implementation and enhancement of the stable crack propagation technique, using the wedge splitting method, for measuring the fracture energy of concrete at the Demar/EEL/USP

Sebastião Ribeiro

FAPESP Grant 2007/55964-3

Development, characterization and in vitro evaluation of biocompatible ceramic pillars based on $ZrO_2-Al_2O_3$ composites

Claudinei dos Santos

FAPESP Grant 2004/04386-1

Recycling of rejects and of PET from used tires and from the industrial production of non-woven textiles

Clodoaldo Saron

FAPESP Grant 2007/07676-9

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ACQUISITION OF COMPLEMENTARY AND SUPPORT EQUIPMENT FOR A SCANNING ELECTRON MICROSCOPY FACILITY

Henrique Kahn

Polytechnic School

University of São Paulo (USP)

FAPESP Grant 2009/54007-0

The Laboratory for Technological Characterization (LCT - www.lct.poliusp.br) at the USP Polytechnic School has provided support to the academic and technological community for more than 15 years in scanning electron microscopy and microchemical analysis, chemical analyses by X-ray fluorescence and X-ray diffractometry, determination of particle and size by low angle laser light scattering. The partnership with the academic community have provided the interaction of the LCT with different research groups within the USP and at other institutions in the development of interdisciplinary projects. The laboratory infrastructure is available for use in the multi-user system or based on the precept of co-responsibility, in which the users share the operational costs. This maximizes the use of the existing resources, the dissemination of advanced techniques of materials characterization, as well as the maintenance of the equipment and of a highly qualified team for its operation. Recently, with the support of the Brazilian Financing Agency for Studies and Projects and the effective participation of a large segment of the academic community, a new field-emission gun scanning electron microscope (Quanta600 FEG; FEI Company) was acquired and installed. That, together with the Stereoscan S440 scanning electron microscope (Leica), has helped to meet the needs of a great number of institutions. However, the wide diversity of applications have brought to light certain restrictions in terms of complementary equipment or accessories in order to take greater advantage of the current resources. Those constitute the object of the present request in the area of scanning electron microscopy.

EQUIPMENT GRANTED

- KH-7700 3D digital microscope - main Control Unit and accessories (Hirox-USA Inc.)
- ChromaCL sample analyzer and accessories (Gatan Inc.) for an FEI Q600 FEG scanning electron microscope
- TegraPol-35 grinder/polisher (Struers Inc.)
- Accutom-50 precision cut-off machine (Struers Inc.)
- MM3A-EM sample micromanipulator (Kleindiek Nanotechnik GmbH)
- D8612 Beam decelerator for Q600 FEG (FEI Company)
- MED020 Modular high vacuum coating system for sputtering evaporation at high-resolution, with accessories (Leica Microsystems)
- Stage Adaptor for coupling the Kleindiek micromanipulator to the Q600 FEG (FEI Company)

ASSOCIATED PROJECTS

Polytechnic School/USP

Development of national processes for the manufacture of bone china

Douglas Gouvêa

FAPESP Grant 2003/12721-2

Microbiology applied to materials science in the area of construction

Márcia Aiko Shirakawa

FAPESP Grant 2006/56860-4

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OPTICAL PATTERN GENERATOR FOR LITHOGRAPHY MASKS AND DIRECT WRITE

Roberto Ricardo Panepucci

Renato Archer Center for Technology and Information
Ministry of Science and Technology
FAPESP Grant 2009/54045-0

This request is aimed at the acquisition of a system for the generation of optical patterns for the lithographic fabrication of structures to be used in novel nanometer- and micrometer-scale devices. There is a gap in this field in Brazil, which currently imports lithography masks and does not possess the technology to produce such devices by direct-write lithography. There are a number of associated projects, with various objectives:

The National Institute of Science and Technology denominated Namitec addresses the use of micrometrics and nanometrics in the area of information and communication technology. The Namitec researchers approach this theme in a broad manner, including applications for wireless sensor networks, projects involving integrated circuits, the development of auxiliary tools for the electronic design automation project, the development of semiconductor devices, and, above all, microsensors, materials, and techniques for the fabrication of devices.

The Photosensitive Materials and Applications project is aimed at coordinating research activities focusing on photosensitive materials in order to deepen knowledge of the mechanisms and processes that allow these materials to respond to light, to use this knowledge in improving the performance of such materials, when possible, and to develop applications such as image/signal processing, the measurement of vibrations etc., as well as the fabrication of diffractive optical components and two- or three-dimensional structures on the micro or nano scale.

The Propagation of Electromagnetic Waves in Complex Structures project has the objective of producing structures based on artificial materials, including metamaterials, and complex materials for the production of surface plasmon polaritons (SPPs), the investigation of electromagnetic cloaking applications in particular. In the case of SPP production, the objective is the investigation of nanostructures for applications in optical sensing and communications.

EQUIPMENT GRANTED

- DWL 66FS Maskless Laser Lithography System and accessory components (Heidelberg Instruments GmbH)
- UV Diode Laser (375 nm; 18 mW) and accessories, including write modules

ASSOCIATED PROJECTS

Renato Archer Center for Technology and Information

Namitec

Jacobus Willibrordus Swart
FAPESP Grant 2008/57862-6

São Carlos School of Engineering/USP

Modeling the propagation of electromagnetic waves in complex structures

Ben-Hur Viana Borges
FAPESP Grant 2007/08384-1

Institute of Physics Gleb Wataghin/Unicamp

Photosensitive materials

Jaime Frejlich
FAPESP Grant 2003/09915-0

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MULTI-USER LABORATORY FOR THERMAL CHARACTERIZATION OF MATERIALS

Jorge Alberto Soares Tenório

Polytechnic School

University of São Paulo (USP)

FAPESP Grant 2009/54140-2

The Laboratory of Thermal Analysis, in the PMT, EPUSP, currently possesses some equipment for conventional thermal analysis, and most of that equipment is still operational. The equipment requested will significantly modernize and complement the analytical capacities of the laboratory, because these devices are more sensitive and more accurate, while having capacities that are complementary to those of the current equipment. The essential focus of research conducted using the equipment in this multi-user laboratory will be the characterization of the thermal behavior of materials (differential thermal analysis, differential scanning calorimetry, and thermogravimetry), complemented by chemical analyses of their components and of the gases emitted during the thermal process (inductively coupled plasma and mass spectrophotometry). This FAPESP Multi-User Equipment Program project involves research teams at USP, Unicamp, UFABC and Mackenzie University, although the majority are affiliated with the Department of Metallurgical and Materials Engineering of Polytechnic School. The project brings together researchers in the areas of metallic materials, polymer science, and ceramics with research that involves microstructural analyses, material properties, and materials processing, as well as environmental aspects related to the treatment of residues and the recycling of materials. The project team members have extensive experience in these areas, which will greatly increase the return of the investment made in this request.

EQUIPMENT GRANTED

- DIL805 A/D Quenching and Deformation Dilatometer and accessories (Bahr Thermoanalyse GmbH)
- STA 449 F3 Jupiter simultaneous thermal analyzer (Thermogravimetry TGA, Differential scanning calorimetry DSC, differential thermal analysis DTA), with two furnaces – from -150° to 1000°C; and ambient temperature at 1550°C (NETZSCH Group)
- TA-QMS 403 C Aëolos quadrupole mass spectrometer (NETZSCH Group)
- Optima 7000 ICP-OES inductively coupled plasma optical emission spectrometer and accessories (PerkinElmer Inc.)
- DSC 200 F3 Maia Differential scanning calorimeter, with liquid nitrogen cooling system – from -170° to 600°C (NETZSCH Group)

ASSOCIATED PROJECTS

University of São Paulo (USP) and São Paulo State University (Unesp)

Study of the separation and utilization of the metallic fractions and the oxides present in the residue generated by the carving of ornamental stones

Jorge Alberto Soares Tenório
FAPESP Grant 2008/53194-9

Injection of residues generated by the fabrication of liquid stainless steel, with a view to recycling

Jorge Alberto Soares Tenório
FAPESP Grant 2003/10428-6

Polytechnic School/USP

Decomposition of the eutectic carbide M₂C in multicomponent white cast iron

Helio Goldenstein
FAPESP Grant 2003/12175-8

Study of surface phenomena associated with tribological films

Andre Paulo Tschiptschin
FAPESP Grant 2003/10157-2

Mathematical modeling of the solidification of binary alloys under the effect of natural convection in the liquid and semi-solid phases

Marcelo de Aquino Martorano
FAPESP Grant 2003/08576-7

Rheological characterization of polymer blends and nanocomposites with clay-reinforced polymer matrices. Study of the rheological correlation properties

Francisco Rolando Valenzuela Diaz
FAPESP Grant no. 2006/02634-3

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PLANNING, ANALYSIS AND RELIABILITY OF ELECTRICAL POWER SYSTEMS

José Roberto Sanches Mantovani

School of Engineering – Campus of Ilha Solteira

São Paulo State University (Unesp)

FAPESP Grant 2009/53841-7

The objective of this FAPESP Multi-User Equipment Program request is the acquisition of equipment for the research laboratories in the Department of Electrical Engineering of the Unesp School of Engineering at Ilha Solteira. The projects associated with this proposal are as follows: Analysis of electrical tension and losses in electrical power distribution systems (FAPESP Grant 2007/07041-3); Planning and reliability of electrical power distribution systems (FAPESP Grant 2007/07629-0); and Analysis of alternative parameterization schemes for continuation power flow and their application in the static contingency analysis (FAPESP Grant 2006/50164-6).

EQUIPMENT GRANTED

- PowerEdge 2900 III Dell server, with DVD-RW burner, monitors, and router (Dell Inc.)

ASSOCIATED PROJECTS

School of Engineering – Campus of Ilha Solteira/Unesp

Analysis of alternative parameterization schemes for continuity of load flow and their application in the static contingency analysis

Dilson Amâncio Alves
FAPESP Grant 2006/50164-6

Planning and reliability of electrical power distribution systems

Jose Roberto Santos Mantovani
FAPESP Grant no. 2007/07629-0

Analysis of electrical tension and losses in electrical power distribution systems

Antonio Padilha Feltrin
FAPESP Grant 2007/07041-3

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ACQUISITION OF A MASS SPECTROMETER FOR IN-DEPTH STUDIES OF THE MECHANISMS OF DEGRADATION OF ORGANIC COMPOUNDS IN REACTORS APPLIED TO WASTEWATER TREATMENT AND TO THE PRODUCTION OF BIOACTIVE COMMERCIAL COMPOUNDS

Marcelo Zaiat

São Carlos School of Engineering

University of São Paulo (USP)

FAPESP Grant 2009/53850-6

Mass spectrometry is a method for identifying the different atoms that compose a substance. A mass spectrometer bombards a substance with electrons to produce ions, or electrically charged atoms. The ions cross a magnetic field that curves their trajectories in different ways, depending on their mass. The field separates the ions in a pattern known as the mass spectrum. The mass and the charge of the ions can be measured by their position in the spectrum, thereby allowing the elements and isotopes present in the sample to be identified. The technique of mass spectrometry is of great importance for research groups that study biological processes, whether for the production of compounds of commercial interest or for the monitoring of environmental pollution. The identification of microbial products final or intermediate, is of fundamental importance for the advancement of such research. With equal needs and similar problems, research groups at the São Carlos School of Engineering (USP) and the Federal University of São Carlos (UFSCar) have been discussing and working to determine which equipment best meets the needs of the two groups, and, to that end, various meetings have been held and lectures have been given by specialists in the area of mass spectrometry. The objective is the acquisition of equipment that meets the needs of both groups. It is hoped that the acquisition of this equipment and the establishment of the technique will allow the respective research groups to conduct studies that are more in-depth and accurate, as well as allowing lines of research that had been abandoned (due to the lack of such techniques) to be reactivated.

EQUIPMENT GRANTED

- AB SCIEX QTRAP 5500 System

ASSOCIATED PROJECTS

São Carlos School of Engineering/USP

Removal of sulfates from acid wastewater in anaerobic reactors

Marcelo Zaiat

FAPESP Grant 2008/00388-0

Development of combined systems of water treatment

Eugênio Foresti

FAPESP Grant 2005/51702-9

Center of Exact Sciences and Technology/UFSCar

Production and purification of clavulanic acid, cephamycin C, and other bioactive metabolites of Streptomyces

Carlos Osamu Hokka

FAPESP Grant 2007/54595-4

A reactive benchtop pneumatic system and its use

Alberto Colli Badino Júnior

FAPESP Grant 2006/04399-1

Patent application filings related to FAPESP Grant 2004/16056-6, 2005/55079-4 and 2005/56982-0

Marlei Barboza Pasotto

FAPESP Grant 2007/54595-4

School of Zootechny and Food Engineering/USP

Characterization and biological anaerobic treatment of dairy wastewater with enzymatic pretreatment for lipid hydrolysis

Giovana Tommaso

FAPESP Grant 2005/04353-9

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SETUP OF A MULTI-USER LABORATORY SPECIALIZING IN THE USE OF NEAR-INFRARED SPECTROSCOPY AND X-RAY DENSITOMETRY IN AGROFORESTRY APPLICATIONS

Mário Tomazello Filho

Luiz de Queiroz School of Agriculture (Esalq)

University of São Paulo (USP)

FAPESP Grant 2009/53951-7

The objective of this request is the establishment of a multi-user laboratory specializing in the use of near-infrared (NIR) spectroscopy and X-ray densitometry methods in agroforestry applications, operating under the auspices of the ESALQ Department of Forest Sciences. We consider strategic to establish a laboratory in this line of research in the State of São Paulo, based on a network of nationally and internationally renowned institutions: 16 universities in six countries (Brazil, Portugal, France, Argentina, Peru, and Costa Rica); and 8 research institutes. The laboratory will have a multiplying effect, promoting the formation of new research groups that will push the frontiers of knowledge in analytical methodologies, making these lines of research competitive at the international level. The laboratory will have the strategy of attracting and aggregating specialists in other areas of knowledge, with common research interests and in the professional training of young investigators and graduate research students. According to the Institute for Scientific Information, as of 2002, Brazilian researchers had published only thirty scientific articles involving NIR spectroscopy: six in the area of agriculture and of forest sciences; and one related to the analysis of wood pulp from eucalyptus trees. Between 2003 and 2009, Brazilian researchers published twenty-four forest sciences or forest products technology studies involving NIR spectroscopy. However, only one of those articles was attributed to an institution in the State of São Paulo. Despite the fact that forestry is one of the most important sectors in Brazil, Brazilian scientific production in forest sciences is still in the incipient phase, with only 6–7 citations/year. In the application of X-ray densitometry, the ESALQ Department of Forest Sciences Laboratory has distinguished itself on the national stage and in Latin America as a whole. As the only laboratory specializing in the use of X-ray densitometry in agroforestry applications,

EQUIPMENT GRANTED

- MPA Fourier-transform near-infrared spectrometer and accessories (Bruker Daltonics)
- QDP-01X Density Profiler (Quintek Measurement Systems)

it interacts with a network of national and international research institutes. However, the equipment employed (scanner and X-ray equipment) were manufactured more than three decades ago, and replacement parts are no longer available, making repairs impossible. There are X-ray equipment available that allow the direct reading of wood samples (processed or unprocessed), dispensing the onerous and prolonged process of creating radiographs.

ASSOCIATED PROJECTS

Luiz de Queiroz School of Agriculture/USP

Application of iodine from sewage and mineral fertilization on the growth, biomass and properties of the wood of Eucalyptus grandis [W. Hill ex. Maiden] trees in forest plantations

Mario Tomazello Filho
FAPESP Grant 2007/59513-6

Log ends remaining after the milling of logs: potential for use as raw material for the production of OSB panels

Geraldo Bortoletto Junior
FAPESP Grant 2007/03156-0

Producing energy from the residues generated from the logging of eucalyptus and pine

José Otávio Brito
FAPESP Grant 2007/03042-5

Processes of water and nutrient transfer/balance in Eucalyptus stands receiving applications of nitrogen and iodine

José Leonardo de Moraes Gonçalves
FAPESP Grant 2002/11827-9

Eucalyptus grandis response to fertilization with potassium and to the replacement of potassium with sodium

José Leonardo de Moraes Gonçalves
FAPESP Grant 2005/60312-0

Functional genomics of photosynthetic genes in sugarcane

Helaine Carrer
FAPESP Grant 2008/52066-7

Institute of Research and Development/Vale do Paraíba University

Study of sun-earth-atmosphere interrelationships through observational and natural measurements

Alan Prestes
FAPESP Grant 2009/02907-8

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ACQUISITION OF A PARTICLE SIZE/DISTRIBUTION ANALYZER, A ZETA POTENTIAL MEASUREMENT SYSTEM, A SPRAY DRYER, AND AN ULTRA-HIGH-PRESSURE LIQUID CHROMATOGRAPH/MASS SPECTROMETER

Miriam Dupas Hubinger

Faculty of Food Engineering

State University of Campinas (Unicamp)

FAPESP Grant 2009/54137-1

The objective of this request is the acquisition of a particle size/distribution analyzer, a zeta potential measurement system, a spray dryer, and an ultra-high-pressure liquid chromatography/mass spectrometry system, for innovation and development in food engineering: encapsulation of bioactive compounds; biofuels research; and the analysis of novel materials. The equipment will be installed in a central laboratory to be set up in an existing space within the Department of Food Engineering. Its use by the petitioning research groups will focus primarily on the areas of the encapsulation of bioactive compounds, the production of biofuels, and the characterization of novel materials. The Faculty of Food Engineering researchers currently outsource particle size and light-scattering zeta potential analyses to other Unicamp departments, which results in a considerable outlay of grant funds for third-party services, because all of the studies conducted in the areas of microencapsulation and new materials research require such analyses. The ultra-high-pressure liquid chromatography/mass spectrometry system, the first of its kind to be made available to research groups in the State of São Paulo, will allow all of the teams involved to make better and more complete characterizations of bioproducts, encapsulated systems, and complex mixtures that occur in the production of biofuels, increasing their competitiveness and international exposure. The acquisition of this equipment will promote a qualitative and quantitative increase in the scientific and technological performance of the teams involved, with an accompanying increase in the number of articles published in indexed journals, and greater international dissemination of their scientific production, potentially culminating in future industrial applications.

EQUIPMENT GRANTED

- ACQUITY SQD ultra-high-pressure liquid chromatography/mass spectrometry system (Waters GmbH)
- Zeta Sizer Nano ZS light-scattering zeta potential measurement system (Malvern Instruments Ltd.)
- Mastersizer 2000 particle size analyzer and APA5005 Optical Bench (Malvern Instruments Ltd.)
- Spray dryer and replacement software

ASSOCIATED PROJECTS

Faculty of Food Engineering/Unicamp

Study of the process of enzymatic hydrolysis of chicken meat and microencapsulation by spray drying

Miriam Dupas Hubinger
FAPESP Grant 2007/54520-7

Microemulsions and nanoemulsions in foodstuffs: rheological, optical, and stability studies

Rosiane Lopes da Cunha
FAPESP Grant 2007/58017-5


Study of oligosaccharide synthesis by Rhodotorula sp. fructosyltransferase

Francisco Maugeri Filho
FAPESP Grant 2005/60768-3

Phase equilibrium and purification processes in the production of biofuels and biocompounds

Antonio José de Almeida Meirelles
FAPESP Grant 2008/56258-8

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ACQUISITION OF A GAS CHROMATOGRAPH MASS SPECTROMETER FOR THE IDENTIFICATION AND QUANTIFICATION OF COMPOUNDS OF INTEREST IN FOOD QUALITY AND HUMAN HEALTH

Neura Bragagnolo

Faculty of Food Engineering

State University of Campinas (Unicamp)

FAPESP Grant 2009/54119-3

The aim of the present research project is the identification and quantification by gas chromatography with mass detector (GC-MS) of compounds impacting on food quality and human health. Cholesterol is a chemically stable compound present in foods; however, it can degrade during processing and storage, mainly due to cell membrane rupture, as well as due to food exposure to heat, light, radiation and oxygen, generating the cholesterol oxides, which are considered atherogenic, cytotoxic, carcinogenic and mutagenic. The natural pigments carotenoids and anthocyanins, in addition to their colorant properties, are bioactive compounds and, consequently, human health promoters, since they play key roles in the body defense system. During food processing and storage, these pigments can undergo degradation, oxidation or isomerization generating new compounds, which can impact both the color and the aroma (volatile compounds) of the final product. The knowledge of the changes in these sensory properties is important to obtain processed foods, such as fruit juices, with acceptable sensory attributes during their whole shelf life. The quality and the shelf life of milk and milk products depend on the enzyme activity and on the chemical reactions of the major milk components. These factors will modulate the formation of volatile compounds which are responsible for the development of desirable flavors or off flavors. The complementary projects aim to monitor the quality of coffee, coffee-based products and peaches canned in a controlled atmosphere by the identification and quantification of volatile compounds. Moreover, the stability of the fatty acids will be verified in the presence of natural antioxidants, the *trans* isomers (*trans* fats) will be characterized and defense response secondary compounds of plants, such as salicylic acid, will be identify. The acquisition of the GC-MS will enable a large increase of knowledge in this area, since the target compounds are directly or indirectly related to food quality and stability, as well as to human health. In addition, the study of such compounds is also fundamental to the development of novel functional food products.

EQUIPMENT GRANTED

- GCMS QP2010 gas chromatograph mass spectrometer (Shimadzu Corp.)

ASSOCIATED PROJECTS

Faculty of Food Engineering, Department of Food Sciences/ Unicamp

Protective effect of natural antioxidants on lipid oxidation in chicken meat

Neura Bragagnolo
FAPESP Grant 2005/03010-0

Integrated evaluation of the stability and functional properties of natural pigments from foods

Adriana Zerloti Marcadante
FAPESP Grant 2005/59552-6

Influence of raw milk refrigerated storage and microfiltration on the quality and shelf life of pasteurized milk

Walkiria Hanada Viotto
FAPESP Grant 2007/55203-2

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ENGINEERING

ACQUISITION OF A SCANNING ELECTRON MICROSCOPE FOR RESEARCH ON THE MICROSTRUCTURE OF AGRO-INDUSTRY RAW MATERIALS, AGRO-INDUSTRY PRODUCTS, AND BIOMATERIALS

Paulo José do Amaral Sobral

School of Animal Science and Food Engineering

University of São Paulo (USP)

FAPESP Grant 2009/53992-5

This FAPESP Multi-User Equipment Program request is bolstered by 3 associated projects and 14 complementary projects, all multi-institutional projects, involving research teams at the USP School of Animal Science and Food Engineering, the Unesp, Institute of Biosciences, Literature, and Exact Sciences at São José do Rio Preto, and the USP Ribeirão Preto School of Pharmaceutical Sciences. The objective is to acquire a tabletop scanning electron microscope (SEM), which has low-vacuum, variable-pressure operation and therefore does not require a sputter coater. This SEM will be set up in a laboratory on the USP Campus of Pirassununga, which lies between São José do Rio Preto and Ribeirão Preto. An SEM is one of the principal devices for the study of the microstructure of foodstuffs, biopolymers, biomaterials and conventional materials. Particularly in foodstuffs, microstructure is understood as the spatial arrangement of identifiable elements and of their interactions, at scales below 100 μm . The typical microstructural elements in foodstuffs include cells, starch granules, proteins, water droplets, oil globules, lipid crystals, and gas bubbles. Some of these elements can be observed in biomaterials, edible films and microencapsulated products, being directly related to their physical properties. Although this will be the first SEM on the Pirassununga Campus of USP, some members of the team have experience with this type of microscopy, as well as having published various articles based on results obtained with equipment located in other cities. This SEM will be employed in studying the microstructure of beef, fish, milk (fresh or powdered), microencapsulated and nanoencapsulated products, dehydrated vegetable extracts, starch, vegetable tissues, biodegradable films, membranes, cement products and material for the treatment of residues (biofilms). One associated project and various complementary projects did not presuppose microstructural analyses. Therefore, the acquisition of the SEM will make it possible to obtain new data, which could lead to new

EQUIPMENT GRANTED

- TM3000 tabletop scanning electron microscope and TMKIT Basic Starter SEM Accessories Kit (Hitachi High-Technologies Europe GmbH)

approaches, consequently having a quite positive impact on the publication of articles in international journals. In the case of the other projects, these analyses could be made with greater frequency and at a lower cost. Making the SEM available to the professors will allow them to make observations that are more detailed and to have access to results other than those furnished by the technicians running the equipment.

ASSOCIATED PROJECTS

School of Animal Science and Food Engineering/USP

Development of biodegradable materials based on castor cake protein, a subproduct of the agroindustrial biodiesel supply chain

Paulo José do Amaral Sobral
FAPESP Grant 2008/11341-5

Effects that the inclusion of sunflower oil, supplemented with selenium and vitamin E, in the diet of lactating dairy cows has on the quantity and composition of the milk produced: influence on human nutrition


Marcus Antônio Zanetti
FAPESP Grant 2008/58633-0

São José do Rio Preto Institute of Biosciences, Literature, and Exact Sciences/Unesp

Study of the viscoelastic behavior of collagen fibers suspended in aqueous solutions in the presence of polysaccharides

Vânia Regina Nicoletti Telis
FAPESP Grant 2006/56015-2

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ACQUISITION OF A SCANNING ELECTRON MICROSCOPE FOR THE LABORATORY OF MATERIALS ANALYSIS OF THE FACULTY OF MECHANICAL ENGINEERING, UNICAMP

Rubens Caram Júnior

School of Mechanical Engineering

State University of Campinas (Unicamp)

FAPESP Grant 2009/54075-6

The objective of this proposal is to re-equip the Laboratory of Materials Analysis of the Unicamp FEM (School of Mechanical Engineering) with a new conventional (low-vacuum) scanning electron microscope (SEM) equipped with accessories for analyses involving energy-dispersive spectroscopy, wavelength-dispersive spectroscopy, and electron backscatter diffraction. The request is bolstered by three projects financed by FAPESP (two Thematic Projects and one Regular Project). It is also supported by numerous complementary projects. The Unicamp/FEM Graduate Program in Mechanical Engineering is divided into three tracks, one of which is Manufacturing Materials and Processes. In the most recent tri-annual evaluation by Capes (2007), that program received a score of 7 out of 7. A significant portion of the scientific production of the program comes out of the Manufacturing Materials and Processes division, which has 22 professors and 100 masters or doctoral students. Many of those researchers routinely use SEM. In 1975, the Manufacturing Materials and Processes division initiated the operation of one of the first SEMs in the country. In 1995, that was replaced with another SEM that was more modern (manufactured in 1988 and donated by IBM of Brazil). In 2004, that second SEM was refurbished, extending its life span, which is, however, now drawing to a close. Our request for the replacement of the existing equipment is founded in the following aspects: (a) the current SEM is quite old (having had 22 years of use), is used extensively, and requires maintenance that has become increasingly more onerous and labor-intensive; (b) the results of its analyses leave much to be desired when compared with those of more modern equipment; (c) the needs of the Unicamp/FEM are centered around conventional equipment, which is less costly than are

EQUIPMENT GRANTED

- JSM 6610LV scanning electron microscope, with optional energy-dispersive spectroscopy, electron backscatter diffraction, and wavelength-dispersive spectroscopy systems (JEOL Ltd.)

high-resolution field-emission gun microscopes, such as those employed at the National Synchrotron Light Laboratory; and (d) the success of research developed at the Unicamp/FEM is highly dependent on having rapid access to the equipment, which makes the use of microscopes at other institutions unfeasible.

ASSOCIATED PROJECTS

School of Mechanical Engineering/Unicamp

Center of excellence in the development and characterization of titanium alloys with applications in orthopedics and dentistry

Rubens Caram Junior
FAPESP Grant 2003/09849-7

Electrosynthesis of hydrocarbons from CO₂ reduction: optimization for the production of methanol

Rodnei Bertazzoli
FAPESP Grant 2006/06672-7

Theoretical and experimental correlations between thermal variables of transient solidification, microstructure and material properties

Amauri Garcia
FAPESP Grant 2005/56580-9

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UPDATE OF THE ELECTRONIC CONTROL SYSTEM, HYDRAULIC SYSTEM, AND SOFTWARE OF A UNIVERSAL MECHANICAL TESTING MACHINE

Sérgio Tonini Button

School of Mechanical Engineering

State University of Campinas (Unicamp)

FAPESP Grant 2009/54138-8

A universal machine for mechanical tests is essential for the determination of several mechanical properties of engineering materials because it allows the evaluation of many characteristics under very different stress states (by tension, compression, bending, etc.), obtaining results related to properties such as mechanical strength, ductility, toughness and fatigue resistance. The mechanical testing machine currently available at the School of Mechanical Engineering has met the needs of a great number of researchers, helping the evaluation of products and materials which they develop in their research projects. This equipment, a material testing system (model 810; MTS Systems Corp.) with load capacity for tests up to 100 kN at room temperature and up to 20 kN at higher temperatures, has been in service for more than 20 years. After 11 years of operation, it underwent the first upgrade of its electronic control system, which significantly improved its operation and data acquisition. However, the equipment has presented many maintenance problems related to the hydraulic system, because of the long time it has been in service. Nevertheless, the frame is preserved and can be kept without affecting the quality of the tests. Therefore, we are requesting the acquisition of a new hydraulic system, the upgrade of the electronic control system and softwares to set up and control specific tests. With this new upgrade, it will be possible to continue to use the equipment and provide the much-needed support to the many studies conducted by the researchers at the School of Mechanical Engineering and at other UNICAMP institutes, as well as by those working at other Brazilian institutions.

EQUIPMENT GRANTED

- FlexTest 40 electronic controller, with model 505.07
SilentFlo hydraulic power unit (MTS Systems Corp.)

ASSOCIATED PROJECTS

School of Mechanical Engineering/Unicamp

Analysis of internal defects in parts manufactured by cross wedge rolling

Sérgio Tonini Button
FAPESP Grant 2008/10191-0

Continuous casting and thixoforming of new Al-Si-Mg and Al-Si-Cu-Mg alloys

Eugênio José Zoqui
FAPESP Grant 2008/03946-4

Production of polycrystalline silicon for the manufacturing of solar cells

Paulo Roberto Mei
FAPESP Grant 2003/10637-4

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ACQUISITION OF A SCANNING ELECTRON MICROSCOPE WITH SUBNANOMETER RESOLUTION AND OF A SCANNING PROBE MICROSCOPE FOR THE CHARACTERIZATION OF NANOSTRUCTURED MATERIALS

Walter José Botta Filho

Center of Exact Sciences and Technology

Federal University of São Carlos (UFSCar)

FAPESP Grant 2009/53929-1

This request is aimed at the acquisition of two modern multi-user devices: a scanning electron microscope with resolutions below one nanometer (0.8 nm at 15 kV and 0.9 nm at 1 kV); and a complete scanning probe microscope. These equipment will be incorporated into the infrastructure of the Laboratory of Structural Analysis(LCE) located in the UFSCar Department of Materials Engineering, complementing and modernizing its capacity for structural analysis of all types of materials at the micrometer, nanometer and subnanometer scales. In this context, the acquisition of these equipment will contribute to the development and nanostructural characterization (by ultra-high-resolution scanning electron microscopy and scanning probe microscopy) of various systems (metals, ceramics, polymers, composites and glass), all having the common characteristic of containing nanometric phases that determine the specific properties of interest. In all cases, the greater spatial resolution that only electron microscope and probe microscopes provide, together with the chemical analysis in small regions and nanometric phases, are of enormous relevance for the characterization of such materials, as well as for identifying the processing protocols that are the most appropriate for the fabrication of nanostructured materials. The LCE fits the definition of a multi-user centralized laboratory and has done so since May of 1988, having been a pioneer in the area of electron microscopy in Brazil.

EQUIPMENT GRANTED

- Magellan 400 L scanning electron microscope, with energy-dispersive X-ray detector (FEI Company)
- Multimode System VS-AM scanning probe microscope, with Ready Head System Package and accessories (Veeco)

ASSOCIATED PROJECTS

Center of Exact Sciences and Technology/UFSCar

Properties of amorphous, metastable and nanostructured metal alloys

Walter José Botta Filho
FAPESP Grant 2005/59594-0

Nanostructured polymeric systems: processing and properties

Rosário Elida Suman Bretas
FAPESP Grant 2006/61008-5

Department of Materials Engineering/UFSCar

Kinetic processes in glass & glass ceramics

Edgar Dutra Zanotto
FAPESP Grant 2007/08179-9

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