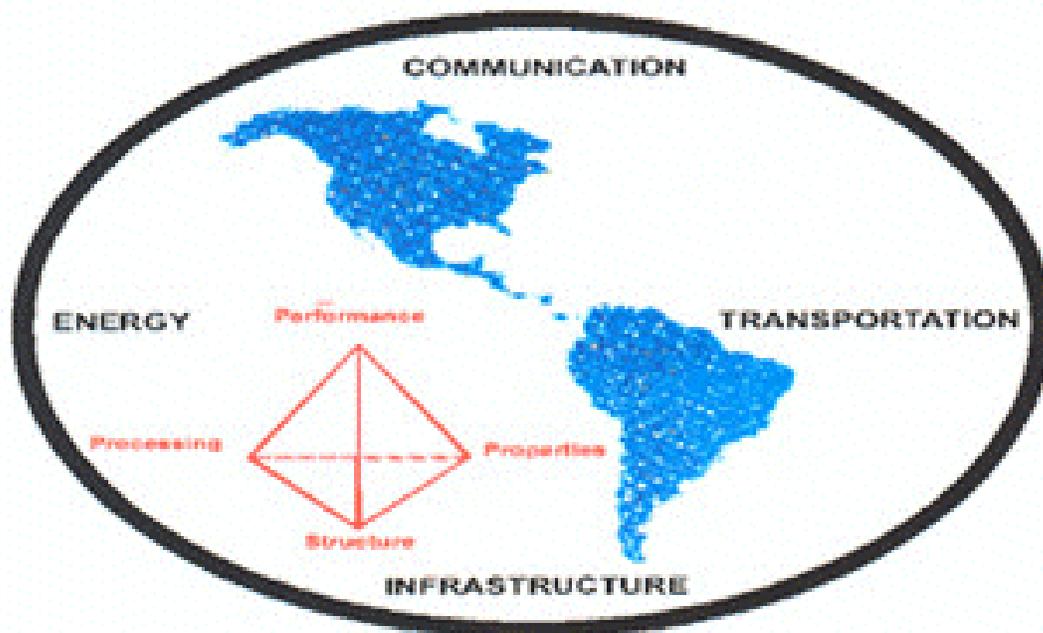


Frontiers in Materials Research, Technology and Education



A Workshop to Advance Pan-American Collaboration

RIO DE JANEIRO, BRAZIL
JUNE 7-10, 1998

Preface

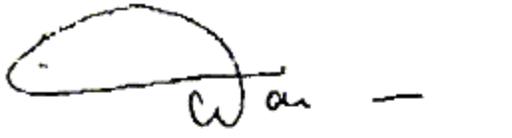
Toward Greater International Cooperation in Materials Research

Materials are more than mere components in technology; rather, the basic properties of materials frequently define the capabilities, potential, reliability, and limitations of technology itself. Improved materials and processes will play an ever increasing role in efforts to improve energy efficiency, promote environmental protection, develop an information infrastructure, and provide modern and reliable transportation and civil infrastructure systems. Advances in materials science and engineering, therefore, enable progress across and broad range of scientific disciplines and technological areas with dramatic impacts on society.

Continued progress in materials science and engineering is increasingly dependent upon collaborative efforts between several different disciplines, as well as closer coordination among funding agencies and effective partnerships involving universities, industry, and national laboratories. In addition, because of the rapidly growing interdependence of the world's economies, partnerships are not only important at the national level but from an international point of view as well.

With this in mind, the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), the Financiadora de Estudos e Projetos (FINEP), the Brazilian Ministry of Science and Technology (MCT), and the Catholic University of Rio de Janeiro of Brazil (PUC-Rio); the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), the Argentinean Secretary of Science and Technology (SECYT), the Argentinean Atomic Energy Commission (CNEA) of Argentina; the Comisión Nacional de Investigación Científica y Tecnológica (CONICYT) of Chile; and the US National Science Foundation (NSF) co-sponsored a workshop in the area of materials research designed to help stimulate enhanced collaboration among materials researchers and create networks linking the participating countries. The workshop was held on June 7-10, 1998 in Rio de Janeiro, Brazil, and was attended by eminent scientists and engineers from Brazil, Argentina, Chile, Uruguay, Venezuela, and the United States. Their excellent report is attached. We would like to thank all the workshop participants and in particular the workshop co-chairs Miguel Blesa, R.P.H. Chang, Guillermo Gonzalez, Guillermo Solórzano, Kathleen C. Taylor, and Edgar Dutra Zanotto for the considerable effort that went into organizing the workshop and preparing the report.

From time to time we expect to communicate with the materials research communities in the Pan American countries as we jointly work toward implementation of the recommendations contained in the workshop report.



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Workshop Summary

Background

A Workshop on Frontiers in Materials Research, Technology, and Education sponsored by the Brazilian National Council for Scientific and Technological Development (CNPq), the Brazilian Granting Agency for Scientific and Technological Projects (FINEP), the Brazilian Ministry of Science and Technology (MCT), the Catholic University of Rio de Janeiro (PUC-Rio), the National Science Foundation (NSF) of the United States, the Argentinean Council for Science and Technology (CONICET), the Argentinian Secretary of Science and Technology (SECYT), the Argentinian Atomic Energy Commission (CNEA), and the Chilean Council for Science and Technology (CONICYT) was held June 7-10, 1998 in Rio de Janeiro, Brazil. The workshop participants were charged with identifying areas for fruitful cooperation among the individual research groups, centers, institutions and funding agencies of the Pan American countries, in the interdisciplinary field of materials research. Other goals of the Workshop were to identify means to stimulate collaboration, to foster future technologies, and to promote and enhance the exchange of materials information. A final goal was to identify mechanisms for optimizing the effectiveness of materials education, and for assuring its relevance to current and future needs. Workshop invitations went out to all North, Central, and South American countries. Workshop participants were from Argentina, Brazil, Chile, United States, Uruguay, and Venezuela.

The workshop chairs were:

Miguel Blesa (CNEA, Argentina)
R.P.H. Chang, (Northwestern University, U.S.)
Guillermo Gonzalez (U. de Chile, Chile)
Guillermo Solorzano (PUC-Rio, Brazil)
Kathleen C. Taylor (General Motors, U.S.)
Edgar Dutra Zanotto (UFSCAR, Brazil)

As the outcome of the meeting, the workshop participants made recommendations to the group of sponsoring agencies about steps to be taken to develop increased Pan American collaboration in materials research, technology, and education. Hopefully, the sponsoring agencies will view the workshop as the model for growing cooperation in these areas throughout the Pan American region. This initiative arises from the increasing globalization of the scientific enterprise and the wish to enhance the mutual resources and considerable strengths of the Pan American community.

Workshop Format

The Workshop explored opportunities for enhancing materials research and education for the purpose of contributing to the development of new technologies. Focus groups addressed the following especially pressing topics: materials for transportation/energy, materials for communications, materials for infrastructure, and materials education. The agenda for the meeting is shown in Appendix 1.

The Workshop began on June 7 with brief speeches from representatives of the participating sponsoring organizations:

Dr. José Galizia Tundisi,
President of the National Council for Scientific and Technological Development (CNPq) and also representing Dr. Jose Israel Vargas,
the Brazilian Minister for Science and Technology

Dr. Lourival Carmo Monaco,
President of the Brazilian Granting Agency for Scientific and Technological Projects (FINEP)

Ambassador Carlos Alberto de Azevedo Pimentel,
Head of the Department for Scientific and Technological Cooperation of the Brazilian Ministry of Foreign Affairs

Dr. Alvaro Albuquerque Júnior,
Special Secretary for Economic Development, Science and Technology of the City of Rio de Janeiro

Pe. Jesus Hortal Sanchez, S.J.,
Rector of the Catholic University of Rio de Janeiro

Dr. Robert Eisenstein,
NSF and representing Dr. Neal Lane, the Director of the National Science Foundation, Washington, D.C.

Dr. Miguel A. Blesa,
Argentinean Commission for Nuclear Energy and also representing the Argentinean Secretary of Science and Technology (SECYT) and the Argentinean Council for Science and Technology (CONICET)

Dr. Guillermo González,
University of Chile and also representing the Chilean Council for Science and Technology (CONICYT)

The second day of the Workshop featured plenary lectures representing the topical areas of the Workshop. These talks set the tone for the discussions of the following day.

On the third day of the Workshop seven groups met in parallel to address each of the topical areas, building upon the information of the plenary talks. Each group was asked to identify links between the topics of research and technology and current materials needs, resource issues, manufacturing technology issues and materials education. The groups identified joint materials research topics offering potential long term benefit and utility from a global perspective. Human resource issues were addressed, as well as conditions needed for successful collaboration (e.g., effective modes of communication). The groups considered regional research strengths, infrastructure issues, and educational needs and opportunities. They also discussed the benefits of involving National Laboratories and industry in the collaborations.

On day 4, the groups gave reports in a plenary session, which allowed all workshop participants to contribute to the workshop report.

Strategic Conclusions

The Workshop participants identified many promising and practical avenues for fruitful cooperation in the interdisciplinary areas of materials research and education within the Workshop focus areas. These suggestions appear in full in the appended group reports. The groups looked especially for actions that are global in nature and address long term societal needs.

Finding effective means to stimulate collaboration was a cross cutting theme for the focus groups. The need to have face to face interaction among researchers is seen as a necessary starting point for collaboration. A theme raised by every focus group was the importance of establishing and funding (a) substantive international academic residencies for faculty, post-docs and students, and (b) strong series of focused Pan American conferences, workshops or summer schools. It was clearly felt that successful exchange programs and conference activities of this kind will automatically catalyze the type of research interactions that are so eloquently called for in other parts of this Report. For example, small invitational workshops focused on a narrow topic, representing areas of overlapping interests and deliberately involving Pan American representation, should be given special consideration by the sponsoring organizations. Funding for joint work should be long-term and formally structured to achieve substantive collaboration.

Another concern common to all groups is the prevailing isolation of industry in general from the research and training activities of universities and government laboratories within the South American countries. A participatory linkage that goes well beyond Aetechnology transfer@ will be important in order to maximize the benefits of materials research and training. Hence, it is recommended that means should be identified to engage industry in cooperative programs with universities and government research institutions, so that the needs of industry will be better comprehended and addressed. Such cooperative programs should be enabled and encouraged to use the existing materials research infrastructure and facilities across institutions and national borders. Remote access for use of specialized experimental facilities in real time, for example, would facilitate cooperation of this kind while providing the additional benefit of bringing researchers together.

Another common theme was the development and establishment of robust mechanisms to enhance the exchange of, and access to, technical and educational information. The Pan American professional societies that represent materials research might take on a greater role in this area, and could also help to identify mutual technical interests and educational opportunities.

Finally, in order to meet the demands in the arena of Materials Research, Technology and Education at the Pan American level, a long-term, well-structured program should be established by the supporting agencies (CNPq, CONICET, CONICYT, NSF) jointly with the leading scientists of the countries involved.

Topical Priorities

The breakout session topics were selected to explore broadly based materials issues and thereby to identify productive directions for future planning. Nonetheless, these topics should be taken only as examples, since other important materials areas are also deserving of attention. Discussions of needs and opportunities during the Workshop breakout sessions revealed both similarities and differences among various countries. Proposed research topics should be selected according to common themes and needs, in order to promote their maximum impact.

Two of the breakout sessions addressed transportation/energy concerns. While energy infrastructure of the Pan American countries differs regionally, ranging from hydroelectric to nuclear to fossil fuels, issues of materials durability and longevity were identified as common to all. New alloy development, environmental degradation of materials, and tribology were among the many topics proposed for collaborative research. New transportation energy sources, possibly including hydrogen for fuel cells, will require new catalysts, sensors, and gas purification and storage techniques. Environmental mandates and fuel efficiency are global issues that create needs for both novel concepts and a total systems approach. Clean materials processing, power generation with clean technologies, recycling and materials lifecycle strategy are all topics that require creative materials research.

The breakout sessions on infrastructure identified many common and emerging themes. Construction materials must be designed more durably in order to resist natural disasters like earthquakes. Examples of such materials include reinforced concrete as well as damping and fracture-resistant materials. Environmental concerns include air and groundwater pollution, purification of water and desalination of seawater, synthesis of waste management materials such as solidification materials, and materials designed for recycling/disposal. Service life prediction and life-cycle costing, including better understanding of deterioration processes and application of modeling tools, were specifically mentioned as applied to a broad range of infrastructure. Research on polymeric materials and new synthesis methods was another cross-cutting theme. Materials for mining and ore processing / purification and for the pulp and paper industries were also cited.

Materials related to the advancement of communication and information technologies were considered by both of the groups on Communications to be very important for collaborative research. The groups identified and provided examples of areas for joint activities, including: nano-electronic devices, novel photonic devices, advanced magnetic recording systems, and the next generation of displays. While the capabilities and infrastructures in each country differ substantially and vary in terms of degrees of sophistication, strong collaborative research teams can nevertheless be formed by carefully choosing partners from the participant countries whose special backgrounds and resources complement each other. Examples of such joint Pan American groups are given in the reports. In addition, the need for improved human resources, i.e. a population of highly trained professionals, was identified as crucial to advancement in this technological area. Therefore, the joint establishment of new materials educational programs, starting at the pre-college level, is strongly encouraged.

The working group on Education highlighted the expected value of developing strong programs for international exchange visits for university faculty and for students; of supporting instructional workshops for materials educators; and of promoting shared development of advanced teaching resources and modern materials curricula. The group also noted the importance of outreach projects aimed at developing a basic awareness of materials issues in the non-specialist community.

Workshop Recommendations

- § *Establish a Pan American interactive communication network to accelerate collaborative research and educational programs and to enhance the exchange, management, and dissemination of information.*

- § *Establish within the sponsoring organizations a Pan American Management council for the purpose of promoting, coordinating, and funding joint programs in materials research and education, and*
 - 1) *to foster collaboration among industry, university, and government laboratories in innovative ways*
 - 2) *to establish mechanisms for long term and substantive collaborations involving academia and industrial and government laboratories*

- 3) *to promote and monitor exchange programs at all professional levels*
 - 4) *to provide program quality assessment and to assure that joint research and educational programs will have societal and technological impact*
 - 5) *to identify areas of important and innovative research for joint collaborative programs*
 - 6) *to ensure that all joint programs are competitive in nature and to assist in the reviews of funded programs*
 - 7) *to promote and assist in the organization of workshops, symposia, and focused meetings*
 - 8) *to enhance public awareness of the contribution of materials science and technology*
- § *Funding agencies, professional societies and other institutions should be solicited and encouraged to act as brokers for multi-national collaborations at all levels, e. g. to facilitate communication among interested international collaborators and organizations.*
- § *The participants strongly recommend that the agencies who supported the workshop (CNPq, FINEP, MCT, PUC- Rio, SECYT, CNEA, CONICET, CONICYT, and NSF) take the lead in developing effective mechanisms to advance Pan American collaboration in materials research and education.*

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