Condensed Matter Physics

Frederico Gama Carvalho

The Group's main field of research is the development and characterisation of materials, using radiation both as a tool to investigate the structure and to induce structural modifications in special samples. Organic-inorganic hybrid materials are currently investigated in collaboration with groups from the University of Aveiro, the University of Sophia, Bulgaria, and Laboratoire Léon Brillouin (CEA-CNRS-Saclay). During 2004 the main effort was put into the preparation and characterisation of hybrid materials with new properties by radiation induced polymer cross-linking.

The group is also active in the area of instrument development, including both hardware and software, design, construction, and testing of systems and components for neutron beam work.

The development of ties with other research groups and a policy of open access for external users to facilities and installations operated by the Group are placed high in the ranking of priorities. Co-operation with European neutron scattering centres is stimulated by the participation, since 1998, in the regular meetings of the European Neutron Scattering Association (ENSA).

Neutron beam facilities. A Two-Axis Neutron Diffractometer (DIDE), and a Small Angle Neutron Scattering Instrument (EPA) are currently under installation in two of the Portuguese RPI research reactor beam tubes. A rotating chopper Time-of-Flight Diffractometer, ETV, is operational. Routine operation of DIDE and EPA is expected to contribute significantly to increase the reactor utilisation and give an additional impetus to the continued operation of the reactor. The TOF diffractometer is a dedicated instrument for testing and student training. The present RPI reactor flux is adequate for the measurement of high dispersive classes of samples and more generally for preliminary measurements preceding data collection at higher flux neutron sources. The reactor also allows in-beam testing of devices such as detectors, collimators and neutron optical components. Upgrading the reactor facility by increasing the power from 1 MW to 5 MW and eventually installing a cold neutron source would open new perspectives for neutron scattering work and the reactor utilisation in general. The corresponding investment should be considered as an option in future development plans of the campus. In 2004, collaboration of the Nuclear Instrumentation Group of the Physics Department continued to be essential in respect to the design and test of electronics and software for the instruments.

Development of components for neutron beam work
In continuation of the work carried out by the Group to establish the validity of the concept of Converging Multichannel Collimation for enhancing the performance of SANS instruments, technical aspects pertaining to the construction of a 100-channel collimator prototype were further investigated. In-beam testing of a composite material with convenient physical and nuclear properties to be used in the channel walls was carried out successfully. Construction of the prototype is currently under way. It is foreseen to test the prototype at a European neutron source, during 2005.

Under contract to the International Atomic Energy Agency, Vienna, and the Greek Nuclear Research Center Demokritos, Athens, two in-pile neutron collimators have been designed. Fabrication under ITN supervision was subcontracted to the Portuguese company ARSOPI, Vale de Cambra, specialized in quality stainless steel components manufacture. The neutron collimators will be installed at two beam ports of the 5 MW Greek research reactor facility.
A new detector system using 8 linear position sensitive ^{3}He detectors has been designed for the Two-Axis Diffractometer DIDE. The new detector that is more robust and simpler than the old “banana” detector will have a resolution essentially equivalent to that of the old detector with double count rate.

Condensed Matter Physics

Research Team

Researchers

- F.G. CARVALHO, Coord. Researcher (75%), Group leader
- F.M.A. MARGAÇA, Principal Researcher
- A.N. FALCÃO, Principal Researcher
- J S. NEVES, Auxiliary Researcher (20%)
- C. M. M. CRUZ, Auxiliary Researcher (20%)

Students

- M. CARRAPIÇO, BIC POCTI, MSc student
- D. SILVA, undergraduate, ITN Grant
- S. GOMES, BIC POCTI, MSc. student

Funding (€)

Research Projects:	32.917,00
Services:	11.000,00
Total:	**43.917,00**

Publications

Journals:	1 and 1 in press
Proceedings:	1 and 2 in press
Conf. Communications:	1
Other publications:	1