

# RAL

## DESIGN & DISCOVERY

### Open Days July 1990

#### RUTHERFORD APPLETON LABORATORY

SCIENCE AND ENGINEERING RESEARCH COUNCIL

## MATERIALS TECHNOLOGY

The Materials Technology Group of Applied Science Division provides a comprehensive materials and chemical service to the Laboratory. Matters relating to materials development and evaluation are covered along with analytical chemistry, general chemistry and aspects of the chemical treatment of cooling waters and trade effluent.

The Physical Measurements Unit within the Group supports materials development and provides active support for many other projects within the Laboratory. Physical and mechanical tests may be performed on materials and components over a temperature range of 4.2K and 600K (-269°C to 320°C). The test equipment includes a mechanical test machine capable of applying loads from 1 Newton to 100 kiloNewtons and associated equipment for measuring the resultant deformation. This machine has been used to measure the properties of many items from fine wires to 4m long blades for a wind powered generator. Other apparatus is available to measure dimensional changes when materials are heated or cooled through temperatures within the range given above. Ultrasonic test equipment is used for the detection of flaws, etc in materials and also provides an important part of the quality assurance procedures for items made within the Group, especially those involving advanced composites. A differential scanning calorimeter (DSC) is also available and this is useful for characterising the degree of cure of resins and for quality assurance tests on pre-impregnated fibres and fabrics.

The Resin Processing Laboratory represents another aspect of the Materials Technology Group and provides facilities for the

manufacture of materials and components by processes ranging from simple casting to advanced composite technology. Current work includes resin systems modified with carbon fibres producing advanced composites for space applications, specialist mouldings for use in neutron beam experiments and the impregnation of superconductive magnets with specially developed resin systems. Clean room facilities are available for the manufacture of certain specialised components from advanced composites or resins.

Processing characteristics of resins and plastics materials may also be evaluated and, together with measurements of the mechanical and thermal properties at a range of temperatures, enables reliable selection of non-metallic materials for use in environments spanning an extremely wide range of temperatures. Experience with the performance of materials in harsh environments (such as aerospace, cryogenics, intense ionising radiation and hydrogen atmospheres) has progressed the science of non-metallic materials selection to the point where reliable predictions may be made from a knowledge of composition and chemical structure.

Analytical chemistry is complementary to materials evaluation and various chemical identification techniques may be applied to both metallic and non-metallic materials as an aid to quality control, such as the determination of the carbon fibre content of composite materials or the composition of a metal alloy. Chemical analysis and knowledge of the composition of materials also advances the understanding of the relationship between chemical structure and properties or



performance. However, the Laboratory as a whole makes much use of the chemical services and many analyses are carried out on a routine basis. The Group also provides advice concerning the safe use of chemically based substances in accordance with the recently introduced regulations on the Control of Substances Hazardous to Health (COSHH).

Within a modern scientific organisation such as the Rutherford Appleton Laboratory there are many requirements that come within the broad definition of chemical services. These may range from water treatment, where a system of chemical dosing is used to control scale and corrosion in the forced draught cooling towers on the site, through chemical cleaning, to the monitoring of trade effluent discharged from the Laboratory campus. The ready availability of chemical advice and facilities is part of the everyday life of the Laboratory. The range of duties undertaken by the Materials Technology Group reflects the wide range of activities currently being pursued at the Rutherford Appleton Laboratory.

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