ized by introducing a layer of silicon nitride at a high temperature, a technique suggested by M. Nomura at the Electrochemical Society meeting in Detroit last October.

Although the operation of a television camera tube is much the same as that of a normal cathode ray tube, the important difference is that the light sensitive detectors, which are scanned many times each second by an electron beam, have to be discharged very quickly between scans. The chief drawback of introducing a resistive layer to do this is that the camera cannot be baked at high temperatures and consequently has a shorter life. It is also expensive to produce.

With the new target, Engeler *et al.* point out that the epitaxial growth covers much of the oxide layer on which the junctions are formed, leaving only a small area susceptible to surface charge. The contrasting electrical properties of the oxide and the devices then ensure that the charges remain just long enough to be detected between successive images. A television picture taken with the new camera target revealed no lag effects due to oxide charging, although there were a few bright spots from shorted capacitors. The spectral response of the camera depended on the thickness of the silicon wafer, being similar to that found in other silicon arrays.

Bell Laboratories devoted much attention to the problems of silicon targets last year, and it has been clear for some time that a head start in the communications business of the 1980s is the prize to be had from the development of a reliable and cheap TV camera system. The work of Engeler *et al.* may prelude just this.

MATERIALS SCIENCE

What Happens at Interfaces

from a Correspondent

INTERFACIAL phenomena was the wide ranging topic of a conference organized at Nottingham on March 19 and 20 by the Materials Science Club and the Wolfson Institute of Interfacial Technology. Mechanical properties at interfaces, particularly in connexion with composite materials, are receiving increasing theoretical and practical attention. Mr B. A. Proctor (Rolls-Royce Ltd) described how surface imperfections influence the fracture processes of high strength solids. Brittle solids can be produced in a high strength state with strengths generally 0·1 to 0·5 times the ultimate theoretical value. Such strengths are primarily controlled by the presence of stress concentrating flaws which are usually associated with the surface of the material. Sometimes, stress activated corrosion mechanisms are found to operate which progressively increase the severity of a flaw when a load is applied in an appropriate chemical environment.

The most important characteristic of an engineering material is its toughness or resistance to crack propagation. In the case of a fibre reinforced composite material, toughness is generated primarily by the characteristics of the interface. Professor J. E. Gordon (University of Reading) discussed the influence of interfaces on crack propagation in fibre-composite materials, for, when the interfacial bond strength is high, the composite as a whole tends to behave as a brittle solid, while weak interfaces deflect cracks and allow fibres to pull out of the matrix. In the latter case, energy is absorbed through frictional losses during failure. The chief problems associated with the use of strong non-metallic fibres in a metal matrix at elevated temperatures, however, arise from chemical interaction and fibre oxidation. Dr E. Holmes (University of Nottingham) described how it may be possible to overcome these problems using thin barrier coatings on the fibers, such as silicon carbide on boron and iridium on carbon fibres.

Although the longitudinal strength and stiffness characteristics of present day fibre reinforced composite materials based on carbon and boron are far superior to metal alloys, the properties of composites measured in other directions are poor by comparison. This problem is strongly influenced by the conflict that exists in the requirements of the bond strength of the interface between fibres and matrix to meet various loading conditions. For high transverse tensile strengths and interlaminar shear strengths, high bond strengths are required, while for maximum toughness very low bond strengths are needed. Professor J. G. Morley (Wolfson Institute) showed how 'Duplex' fibres containing two separate sets of interfaces offer a possible practicable solution to this problem.

With two-phase polymeric systems the problems are quite different. Dr Henno Keskkula (Dow Chemicals) showed how in these particular composites, mainly based on the rubber reinforced polystyrene systems, grafted rubber influences the mechanical properties. In the first instance the stability of the material at the pre-polymer state is due to the presence of the graft, but subsequently on complete polymerization the final properties, such as observed in dynamical mechanical or impact testing, are also related to it. In particular a mechanical blend of rubber and polystyrene has a much lower impact strength and loss peak area than a grafted polymer of the same composition. Electron microscopy shows this graft to be present at the interface between the continuous polystyrene phase and the dispersed phase of rubber particles.

Some electrical properties at interfaces are undesirable, certainly those connected with the surface breakdown of insulators. Dr E. C. Salthouse (University of Durham) explained that in many cases the design of the insulation surface is all important, yet the fundamental factors involved are only partially understood. Surface breakdown is initiated by leakage currents flowing in the absorbed water or wet pollution, inevitably present on the surface. Non-uniform loss of moisture from the surface causes a distortion of the voltage gradient along the surface and partial gas discharges are initiated. These lead to failure by degradation of the surface of flashover.

HELIUM

Mass Waves in Helium Mixtures

by our Solid State Physics Correspondent

INVESTIGATING the effects of impurity atoms on otherwise perfect physical systems has proved to be a highly rewarding activity, giving birth to such subjects as the doping of semiconductors, the alloying of metals and Mössbauer spectroscopy. One unusual impurity system which has so far produced a wealth of baffling nuclear magnetic resonance (NMR) data is that of helium-4 in helium-3, which exists in a cubic lattice structure at very low temperatures, and R. A. Guyer