cumulates at the lower leaf margins of chrysanthemums causing necrosis. Its distribution has been confirmed by autoradiography with ^{14}C-pirimicarb-treated plants. Pirimicarb smokes are safe at the recommended rate but an eight-fold increase produced varied damage. Thus with carnations the growing tips were scorched, only the older leaves of cucumbers were damaged, cyclamen were unharmed, and primula petals unaffected whereas the leaves were damaged. An experimental pirimiphos-methyl formulation produced localised scorch on citrus fruit when spray droplets dried concentrating the insecticide. No damage occurred with a formulation that dried more uniformly.

Flies in mushrom houses are controlled by mixing insecticides with the casing layer or with the compost though yield reductions have been suspected. I. J. Wyatt (Glasshouse Crops Research Institute) described trials in which diazinon and chlorfenvinphos (from 10 to 2,000 mg kg^{-1} casing) reduced mushroom numbers in the early flushes and increased them in the later. When numbers were decreased, however, the mushrooms were larger, resulting in increased yields with low rates of insecticide. The compounds were more persistent in the compost and tended to reduce yields in all flushes. A simple computer-fitted model described the behaviour. G. A. Wheatley (National Vegetable Research Station) also described unexpected effects produced by insecticides in trials. Chlorfenvinphos gave good control of cabbage root fly damage on mini-cauliflowers but the yield was less than with diazinon, which gave poor control. On conventional cauliflowers, curd diameter increased progresively with increasing diazinon dose, but not with chlorfenvinphos or fonofos although they gave better protection against cabbage root fly larvae. Phorate and *S-tert*-butyl *OO*-diethyl phosphorodithioate controlled carrot fly and affected plant survival. Although total yield did not change much, the size of the carrots was affected and hence their suitability for specific markets. Different ways of using chlorfenvinphos altered sizes of Brussels sprouts with similar implications.

E. Griffiths (University College of Wales, Aberystwyth) reviewed the effects of fungicides on leaf rust and coffee berry disease affecting coffee in East Africa. One spray of Bordeaux mixture doubled yields even in the apparent absence of disease. It became an annual treatment known as 'tonic copper spraying', though other fungicides produced the same effect and both diseases can be aggravated. Without further control measures rust may later develop more quickly in the thickly foliated trees that result from 'tonic spraying'. Coffee berry disease infection can come from berries or the fungus living saprophytically in the bark of maturing shoots. Fresh spores from bark sprayed 14 months earlier are more infective than those from untreated trees. Do the fungicides affect the tree or other microorganisms?

Introducing a lively discussion, Q. A. Geering (Fisons Ltd, Agrochemical Division) stresed that many of the effects described had been obtained with higher doses of pesticides than used commercially.

Insulator layer formed in silicon

from our Solid State Physics Correspondent

THE frequency of publication on ion implantation indicates that this technique may be catching on as a technological tool (see, for example, the recent book *Ion Implantation* by G. Dearnealey, J. H. Freeman, R. S. Nelson and J. Stephen (North-Holland, Amsterdam, 1973). In the research journals and at conferences, every week seems to bring a new idea for making use of ion implants in microelectronics. A beam of ions projected at kilovolt energies into the surface of an electronic material forms a burned layer of implant atoms, in a matrix of atoms of the host material. The properties of that layer are, of course, different from the original material. For semiconductors it has been realised for some time that by varying the ion used, its energy and the subsequent heat treatments, one can form either a layer which is more strongly conductive than the original semiconductor or a glassy layer which is still a semiconductor but much less conductive. It has only been clear since about 1970, however, that, by implanting a high concentration of a reactive ion, a layer of insulating compound can also be formed.

Dexter and Watelski of Texas Instruments, Dallas, and Picraux of Sandia Laboratories, Albuquerque, (*Appl. Phys. Lett.*, **23**, 455; 1973) have now reported a particularly useful application of that finding. They have used bombardment wafers of silicon with nitrogen ions to form a buried silicon nitride layer and then, by etching grooves, they have produced slabs or 'mesas' of silicon which are isolated from the body of the silicon wafer. 'Dielectrically isolated' devices can then be formed in these slabs—a useful form of device in the preparation of fast interference-free integrated circuits. The surprising and novel feature of the implantation method was that, even with the high ion dose used (more than 10^{17} ions cm^{-2}) the silicon left above the buried layer was free of defects after heat treatment at 1,200° C. Proton channeling showed a near-perfect lattice and the silicon would support the epitaxial growth of a similarly defect-free crystalline silicon film of thickness 0.2 μm. The important point about the film quality was its superiority in comparison with a competing process, namely the epitaxial growth of silicon films on sapphire. The latter process has been used to manufacture integrated circuits but suffers from some drawbacks such as inhomogeneity of impurities and defects in the silicon and expensiveness and difficulty in working the sapphire.

The buried 'nitride' films had a breakdown strength which approached that of pure silicon nitride, breaking down at a field of 5 × 10^6 V cm^{-1}, although, theoretically, there is not enough nitrogen present to form the compound Si_3N_4. It seems that it will be possible to form diffused transistors and diodes in this silicon layer of 0.2 μm and interconnect them into an integrated circuit. This method could prove cheaper, simpler and hence more reliable than the present methods for dielectric isolation which, with the exception of the silicon-on-sapphire technique, involve the difficult stage of lapping off the body of the silicon wafer after mesas, formed by etching, have been somehow secured in a solid dielectric matrix.

A warning against overoptimism concerning this method should, however, be inferred from the almost simultaneous publication of an article describing unexpected migration of defects beyond the range of implanted ions themselves. Clearly, high dose implantation and the required high temperature anneals which follow, place a large stress on the electronic materials involved which may lead to new, unexpected and frustrating forms of damage effect.

Superfluidity in thin helium films

from our Condensed Matter Correspondent

THE superfluid content of very thin adsorbed helium films has been measured directly, using a quartz crystal as a microbalance, by Chester and Yang of the University of California, Los Angeles (*Phys. Rev. Lett.*, **31**, 1377; 1973).

Bulk liquid ^{4}He below T_λ, its superfluid transition temperature, behaves in many ways as though it were a mixture of two entirely different but completely interpenetrating fluids a so-called normal fluid component which, with finite viscosity and entropy, is much like any other liquid; and a superfluid component