

particularly promising. For example, a small bent piece of the alloy could be kept with a blood sample in transit to check whether a critical temperature had been exceeded: the piece would straighten irreversibly at this temperature, which could be varied within wide limits by adjusting the composition of the alloy. By controlling the release of stored refrigerant, a 'Nitinol' valve could not only monitor but also control temperature in transit. Possible applications for artificial muscles and for the design of an efficient miniature heat engine for artificial hearts are being investigated, and so is the design of self-tightening linkages for repairing bone fractures, particularly of the jaw.

NITROGEN

New Tetragonal Phase

from our Solid State Physics Correspondent

SOLID nitrogen is known to exist in three distinct forms—the α phase, which is cubic, the β phase, which is hexagonal, and the recently discovered γ phase. The crystal structure of the γ phase, which only exists at pressures above 3,500 atmospheres and at very low temperatures, has now been measured by X-ray diffraction and found to be tetragonal with a c to a ratio of 1.29 (*Phys. Rev. Lett.*, **23**, 1154; 1969). R. L. Mills and A. F. Schuch at Los Alamos carried out the measurements at 4,015 atmospheres and 20.5 K. They took twenty X-ray photographs of the γ nitrogen and found that the observed composite of ten different reflexions could be indexed satisfactorily on the basis of a tetragonal lattice.

New intermolecular forces clearly come into play when such great pressures are applied. Both the α and β phases are close packed structures, and Mills and Schuch suggest that the arrangement of molecules implied by the tetragonal structure of the γ phase points to a minimization of the electric quadrupole-quadrupole interaction energy of the crystal. They visualize the lattice as made up of intermeshing layers of molecules in the shape of rugby balls. The surface of the balls, of course, represents a given contour level for the charge distribution of the electrons. In each layer the axes of the molecules are parallel, alternate layers with axes pointing normal and parallel to the planes respectively.

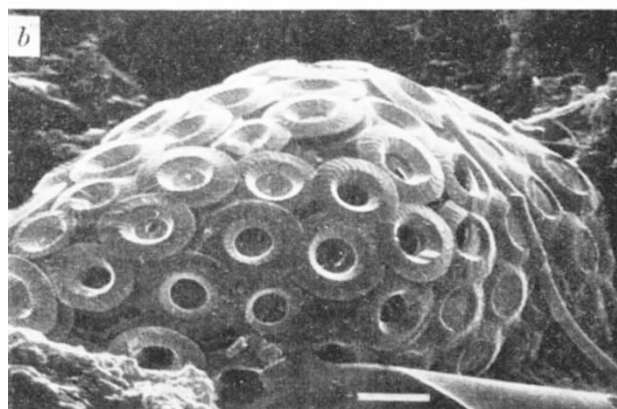
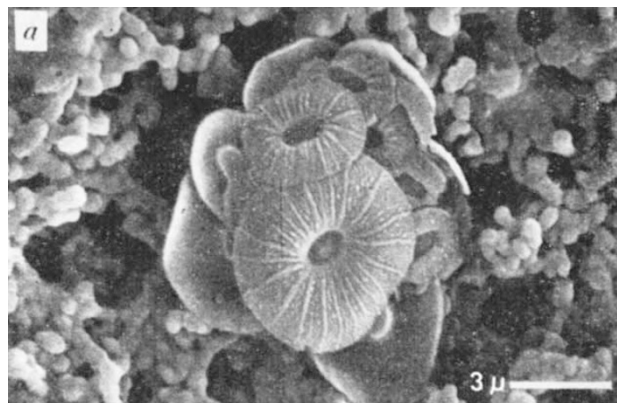
The exact structure of the α phase of solid nitrogen has also been called in question. At a recent meeting of the Faraday Society in Oxford, attention was drawn to a discrepancy between the predictions from X-ray diffraction and spectroscopic investigations. The accepted structure of the α phase is face-centred cubic, with the four molecules in the simple cubic cell each having their own particular (111) orientations. The X-ray measurements, however, seem to indicate a slight deviation from this pattern, with each molecule shifted 0.17 Ångströms away from its prescribed site, in a direction parallel to its own axis. These deviations were not found in spectroscopic studies, however, when the four superlattices appeared to lock perfectly together into a face-centred cubic structure.

The cubic phase exists below 35.6 K, and the hexagonal phase between 35.6 K and the melting point, 63 K. The tetragonal γ phase has a triple point with the other two at 44.5 K and 4,650 atmospheres.

MARINE BIOLOGY

Pacific Plankton

THESE fine specimens of nannoplankton were collected from the south-west Pacific earlier this year by Professors Susumu Honjo and Hisatake Okada of Hokkaido University in Japan. The scanning electron micrographs show (a) *Umbellosphaera* cf. *tenuis* and (b) *Umbilicosphaera mirabilis*.



AGRICULTURE

New and Better Fungicides

from our Botany Correspondent

ONE of the bright spots in the future of British agriculture is the promised development of fungicides which can be applied to the soil or the seed, or sprayed on the leaves to protect crop plants from a wide range of diseases. This is a great advance on existing treatments that have to be given after the diseases have started to develop. Progress reports on some of these systemic fungicides, so called because they spread throughout the plants, were given at the British Insecticide and Fungicide Conference, held at Brighton from November 17 to 20.

Benomyl ('Benlate', Du Pont, methyl 1-(butyl carbamoyl) 2-benzimidazolecarbamate), a systemic fungicide which has been on trial in the United Kingdom for three years, is particularly effective against ascomycetes and fungi imperfecti. Dr W. S. Catling (Du Pont, Ltd) reported that benomyl has been used successfully as a seed dressing, foliar spray or soil dressing to control the fungi causing various diseases in many kinds of fruit, vegetable crops and ornamental