

The titano-magnetite seams of the Main Zone show the same persistency and continuity, but have not been exploited to date. Titanium is now assuming importance in metallurgy and there is little doubt that treatment of these ores will be attempted in the future. Contained in the titano-mag-

netite ore is a persistent fractional percentage of vanadium. The total reserves of titanium and vanadium in these iron ores must be very large.

It is obvious, therefore, that the ores of the Bushveld igneous complex occupy a prominent place in the world's mineral resources.

#### References

- |               |         |   |
|---------------|---------|---|
| P. A. Wagner  | .. .. . | The Platinum Deposits and Mines of South Africa. Oliver and Boyd, Edinburgh, 1929   |
| A. L. Hall    | .. .. . | The Bushveld Igneous Complex of the Central Transvaal. Memoir 28, Union of South Africa Geological Survey. Government printer, Pretoria, 1932 |
| A. L. du Toit | .. .. . | Geology of South Africa. Oliver and Boyd, Edinburgh, 1954   |

## Synthesis of Fluoroaromatic Polymers

### INTERMEDIATES FOR HIGH-TEMPERATURE PLASTICS

A research programme on the synthesis of fluorocarbon polymers for possible use in high-speed aircraft, ordnance equipment and other types of high-temperature application has recently been carried out at the National Bureau of Standards. Most plastic materials at present available are not capable of withstanding high-temperature conditions but it is thought that polymers derived from completely fluorinated aromatic compounds should have considerably improved resistance to temperature and also to radiation.

Hexafluorobenzene provides a convenient starting point for the synthesis of such polymers and the discovery of a method for its synthesis in reasonable yields and quantities (M. Hellman, E. Peters, W. J. Pummer and L. A. Wall, *J. Amer. Chem. Soc.*, 1957, **79**, 5654-5656) has greatly accelerated their development. Hexafluorobenzene is obtained by pyrolysis of tribromofluoromethane in a platinum tube 80 cm long, 1 cm wide and about 1 mm thick packed with platinum gauze. The best yields, 55 per cent, were obtained at 540-550°C under a nitrogen pressure of 4.5 atm.

Pentafluorophenol, one of the most useful

compounds obtained from hexafluorobenzene, is prepared by the addition of solid potassium hydroxide to its pyridine solution. The hydrogenation of hexafluorobenzene using a platinum-on-carbon catalyst at 300°C gives a high yield, 40 per cent, of the monohydro derivative, pentafluorobenzene, together with 10 per cent tetrafluorobenzenes (R. E. Florin, W. J. Pummer and L. A. Wall, *J. Res. Nat. Bureau Standards*, 1959, **62**, (March), 119-121). The catalyst maintains its activity for long periods. The main products of the reduction can be brominated to pentafluorobromobenzene and dibromotetrafluorobenzene or iodinated to the analogous iodides. The presence of the reactive bromine or iodine atoms makes such compounds invaluable intermediates for the preparation of further fluorocarbons and their polymers.

So far successful attempts to prepare polymers have been made using sodium pentafluorophenolate, diiodotetrafluorobenzene and pentafluorobromobenzene as starting materials. It is expected that such polymers will possess the combination of properties necessary to give both high thermal stability and plasticity.