of a lower resolution than that obtainable with a low energy photon source (for example, He(I)) is not too serious because there are so many energy levels compressed into a relatively small energy range. The observations of sharp well defined bands in PTFE and other polymers show the potential usefulness of ESCA in the study of such systems.

Table 1 Experimental and Calculated Band Separations

Experimental separation (eV)	Calculated separation (eV)*
A-B	13.6
A-C	20.2
A-D	24.8

* Measured from the top of the F_{2s} band to the centre of the other three bands.

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New Method of Isentropically Compressing Materials to Several Megabars

In the past, very high pressures in materials have been attained by static high-pressure techniques and dynamic shock-wave techniques. Static presses have been designed and operated to pressures up to about 500 kbar although there may be errors in the pressure scale at pressures much above 200 kbar. With shock-wave techniques it is possible to reach pressures up to 10 Mbar in dense materials such as heavy metals. Unfortunately, this technique is much less effective for more compressible materials. For example, a shock wave system which could produce a shock pressure of 10 Mbar in tungsten could only produce a pressure of about 150 kbar in liquid hydrogen. One method of circumventing these difficulties is the use of a magnetic field as a coupling medium between a sample and a metallic liner imploded by high explosives. As the pressure is essentially hydrostatic, the compressibility of the material makes little difference. Further, the buildup of pressure is relatively slow, the compression is isentropic and high pressures can be reached without the large temperature increase encountered in shock-wave experiments.

We have adapted the magnetic flux compression techniques of Fowler *et al.*¹ to compress materials to pressures of several

megabars². We have performed experiments on lucite (polymethylmethacrylate) and caesium iodide. The lucite was compressed to about 0.20 of its initial volume ($\rho_0 = 1.18 \text{ g cm}^{-3}$) at a pressure of about 4 Mbar. The caesium iodide was compressed to about 0.25 of its initial volume ($\rho_0 = 4.51 \text{ g cm}^{-3}$) at a pressure of about 3 Mbar.

Fig. 1 Cross-section of the apparatus.

Fig. 1 shows a cross-section of the experiment. A capacitor bank and coils are used to provide an initial field of about 65 kG. The cylinder of high explosive implodes the stainless steel liner (4 inches in diameter and 18 inches long) and compresses the magnetic flux. The field intensity increases to about 10 MG and exerts a pressure of about 4 Mbar on the copper tube (0.5 inch in diameter) containing the sample. The time to raise the pressure to 4 Mbar is about 10 μs and is long enough to avoid shock formation in the sample.

This technique has been developed in order to measure the low temperature, high pressure equation of state and properties of liquid hydrogen, which has been predicted to become a metal in the mbar region. The properties of metallic hydrogen have been debated for several decades, and it is hoped that they can be investigated by this technique. Complete details of these experiments and others will be published in the future.

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