

which had not been irradiated at all. The powder photograph recently taken of the pressure-induced sulfur-selenium phase made 2-1/2 years ago is the same as that taken 2-1/2 years ago, that is, none of the fibrous sulfur (II) type phase is present. This implies that the irradiation began the decomposition of the crystal used to obtain the data for the structure determination.

#### SULFUR-TELLURIUM

Prior to the work<sup>3</sup> on sulfur-tellurium that was done in our laboratory, no phase simultaneously involving these two elements was known. Inasmuch as the information on the new phase has already been published, we shall only summarize the results here.

The new phase is found only by reaction in the solid state; melting causes segregation of sulfur and tellurium. The phase has the formula  $\text{Te}_7\text{S}_{10}$  and was prepared by pressurizing an intimate mixture of appropriate proportions of Te and S at 40 kb and 400-412°C for 4 to 5 days. Crystal chemical and geometric considerations led to the deduction of the correct formula of the phase and to a proposed atomic arrangement in it.

At first, high pressure experiments with various proportions of Te and S led to the conclusion

that the chemical formula of the phase was very close to  $\text{Te}_3\text{S}_4$  which could not be a valency compound. The x-ray powder diffraction lines occurring in the powder patterns of all specimens established that there was no solid solution range in the phase. The other phases which appeared were hexagonal Te on the Te rich side and fibrous sulfur (II) on the sulfur rich side. It turns out that a seven atom increment of the Te helix is, within experimental error, the same length as a 10 atom increment of the sulfur helix (Fig. 5) and the van der Waals "cylinders" (Fig. 6) of the two have very nearly the same radius. Thus the lattice constants of a pseudoorthorhombic cell could be deduced for this phase. Because the Te helix has three atoms per turn, the repeat distance along the helix axis must be three times that of the seven atom increment of Te helix. The pseudoorthorhombic cell has lattice constants  $a = 41.49$ ,  $b = 31.64$ ,  $c = 9.24$  Å. (The monoclinic cell has  $a = 41.49$ ,  $b = 9.24$ ,  $c = 26.09$  Å,  $\beta = 142.7^\circ$ ) An idealized packing scheme of the proposed sulfur and tellurium helices is shown in Fig. 6.

The pseudoorthorhombic cell contains 240 S and 168 Te atoms leading to an x-ray density of  $3.99 \text{ g/cm}^3$  as compared with a

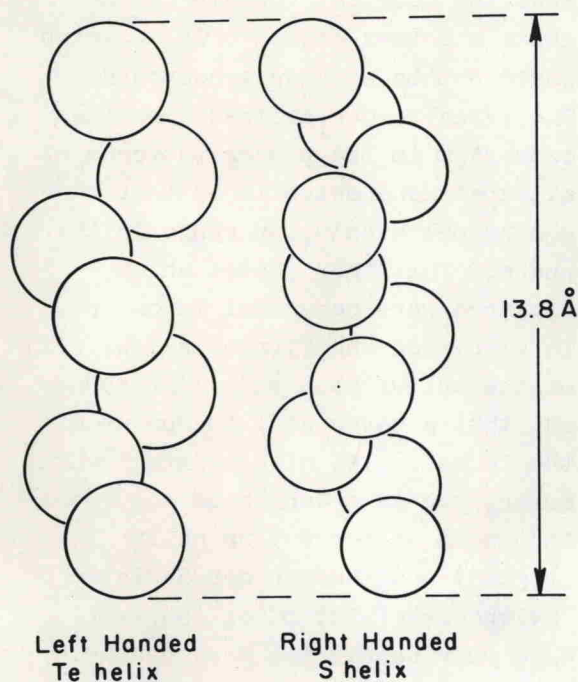


Fig. 5. The relation of the sizes of a seven-atom increment of Te helix to a ten-atom increment of S helix.

measured density of  $4.02 \text{ g/cm}^3$ . Further the lattice constants given above allowed a completely satisfactory indexing of the powder pattern.

#### TERNARY PHASES

Preliminary experiments have revealed the existence of at least three pressure-induced ternary phases.

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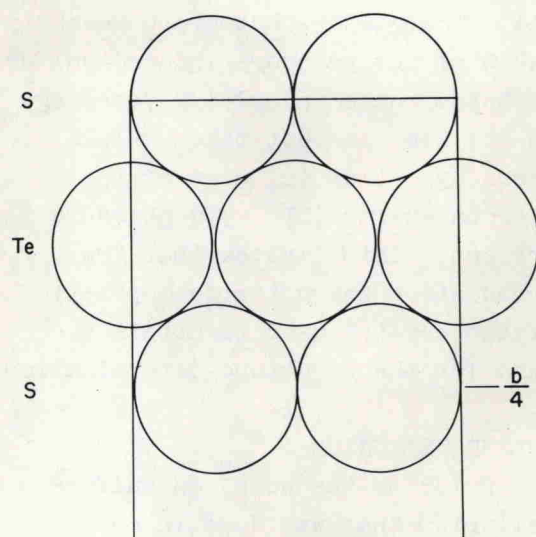


Fig. 6. Idealized packing of S and Te helices. The circles, drawn to scale, represent projections of the van der Waals "cylinders" circumscribing the helices.

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