silica gel; 0.7 g. of 2,5-diphenylhexane was obtained, n^{20}_{D} 1.5385 (literature[23] n^{20}_{D} 1.5440).

Anal. Calcd. for $C_{18}H_{22}$: C, 90.70; H, 9.30. Found: C, 90.36; H, 9.10.

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EVANSTON, ILLINOIS

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COMMUNICATIONS TO THE EDITOR

EVIDENCE FOR QUADRIVALENT CURIUM. II. CURIUM TETRAFLUORIDE[1]

Sir:

We wish to report the preparation and some properties of a new compound of curium, the tetrafluoride, in which *curium has unequivocally the valence of four.* Curium tetrafluoride was made by treatment of curium trifluoride with gaseous fluorine at elevated temperatures, and lattice constants have been measured for the monoclinic structure obtained.

Cm^{244}, an alpha emitter of 18.4 years[2] half-life, was used in this investigation and was a fraction of the same curium stock previously employed to prepare CmO_2.[3] The Cm^{242} content was only $\sim$ 0.004 mass per cent.

TABLE I (Å. UNITS)

	a_0	b_0	c_0	β	Ionic radius (IV)
UF_4[5]	12.82 ± 0.06	10.74 ± 0.05	8.41 ± 0.05	126°10′ ± 30′	0.93[6]
NpF_4[5]	12.70 ± .06	10.64 ± .05	8.33 ± .05	126°10′ ± 30′	.92[6]
PuF_4[5]	12.62 ± .06	10.57 ± .05	8.28 ± .05	126°10′ ± 30	.90[6]
AmF_4[4]	12.49 ± .06	10.47 ± .05	8.20 ± .05	126° ± 1°	.89[6]
CmF_4	12.45 ± .06	10.45 ± .05	8.16 ± .05	126° ± 30′	.88

A 20–30 microgram pellet of air-dried curium trifluoride, precipitated from aqueous solution, was transferred into a sintered pre-fluorinated calcium fluoride crucible. The crucible was inserted into a nickel fluorinator[4] and the fluorinator evacuated. Tank F_2, which had been through a NaF trap to remove HF, was then used to fill the fluorinator to 1 atmosphere pressure. The fluorinator was heated to 400° over a one-half hour period, held at 400° for one hour, then at 300° for one hour, and finally cooled down to room temperature. A slow stream of fluorine was passed through the apparatus during this cycle. After the fluorine was displaced by helium gas, the curium compound was transferred to a Pyrex X-ray capillary and sealed off in air.

Initially, an exposure of 2 hours was made, using 114.6 mm. diameter camera with no-screen film and unfiltered copper radiation. This gave a good quality powder pattern of monoclinic CmF_4. A 20-hour exposure of the same sample was made subsequently using the same camera, Eastman Type A film, and filtered copper radiation. The longer exposure gave a picture of generally poorer quality, due probably to radiation damage to the crystals.

In Table I are listed X-ray data for several tetrafluorides and their lattice constants in Å. units. All of these show the same monoclinic structure found for CmF_4.

Under microscopic examination by Eugene Staritzky of this Laboratory, the curium tetrafluoride appeared as light greenish-tan aggregates with a crystal size of a few tenths of a micron. The mean refractive index was 1.62. The absorption spectrum, as viewed through a Zeiss prism spectrometer eyepiece, showed a single very strong, narrow band at 452 millimicrons, which is not shown by Cm(III).

The existence of the compound CmF_4 illustrates the difficulties of deriving chemical conclusions from the electronic configurations assigned to the "actinide elements."[7] It is clear, and perhaps surprisingly so, that the stability of the $5f^7$ half-filled shell in curium is markedly less than the stability of the corresponding $4f^7$ half-filled shell in gadolinium. The present results re-enforce earlier observations that detailed predictions of the valence states of these elements may not be properly made on the basis of analogy to the lanthanide series.[8]

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