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Short Communication

Reduction of sulphur hexafluoride by lithium aluminum hydride

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It has been observed that a slurry of lithium aluminum hydride in ether reduces sulphur hexafluoride at room temperature (25°).

About 500 mg of lithium aluminum hydride in 10 ml of dry ether were reacted with 10–20 ml of sulphur hexafluoride in a tube fitted with ground joints. The gas used was a commercial product of Kali-Chemie AG, Hanover, with a purity of >99,9% by weight. As confirmed by a blank experiment, the lithium aluminum hydride contained no trace of sulphur.

The reactants were kept at room temperature for 4–7 days (25 ± 2°) with occasional shaking. After this the excess lithium aluminum hydride was slowly decomposed by adding a chilled mixture of water and ether, followed by 10 ml of 1 : 1 hydrochloric acid in order to evolve hydrogen sulphide from the hydroxide suspension.

All the gases liberated were swept in a current of nitrogen and bubbled through an alkaline cadmium hydroxide suspension (25 ml of 1 *N* alkali and 5 ml of 2% cadmium acetate) which was estimated iodometrically[1]. The fluorine content of the reaction tube was estimated after distillation by the modified method of Willard and Winter[2].

The analytical results are listed in Table 1 below. It is easily seen that 10–30% of the sulphur hexafluoride undergoes reduction after a period of 4 days to a week (Slurry No. 1–4).

These results clearly indicate that only partial reduction occurs and the rate of reaction is very slow under these conditions. In the case of intensified contact between the gas and the reductant the reaction was expected to become faster and perhaps go to completion.

Evidence for this assumption was obtained by further experiments, in which the reaction mixture was agitated on a magnetic stir plate (Slurry No. 5–6).

This is another instance of the reaction where the very stable sulphur hexafluoride molecule is attacked by a strong reducing agent at room temperature, the other being its reaction with alkali metals[3].

TABLE 1

REDUCTION OF SULPHUR HEXAFLUORIDE BY LITHIUM ALUMINUM HYDRIDE

Slurry No.	Time of reaction	SF_6 (mg)	Sulphur		Fluorine		% Reduction
			Theoretical (mg)	Observed (as H_2S) (mg)	Calculated from sulphur reduced (mg)	Observed (mg)	
1	4 days	156.30	34.34	5.10	18.17	17.74	14.85
2	4 days	127.40	27.97	3.66	—	—	13.20
3	5 days	65.13	14.27	1.91	—	—	13.40
4	1 week	88.61	21.14	5.92	21.09	21.85	28.00
5a*	7 h	275.00	60.26	7.28	—	—	12.10
5b	7 h	281.00	61.58	7.10	—	—	11.50
6a**	41 h	278.50	61.02	20.05	—	—	32.90
6b	41 h	285.00	62.43	20.15	—	—	32.30

* In run No. 5a and b, a total of 1 g $LiAlH_4$ was added at the beginning of the reaction.

** In run 6a and b, 0.5 g $LiAlH_4$ were taken at the beginning; after a reaction period of 8 and 35 h, two further portions of 0.5 g each were added (a total of 1.50 per run).

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