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# Chemistry

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## Abstract

## Full Text

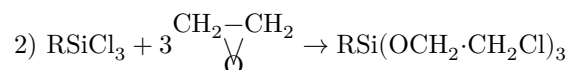
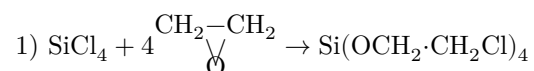
*Chemistry*

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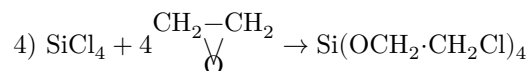
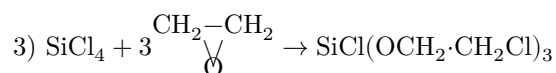
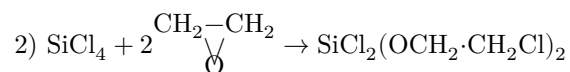
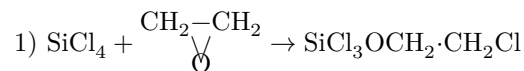
# THE REACTION OF ETHYLENE OXIDE WITH SILICON TETRACHLORIDE AND ETHYLTRICHLOROSILANE

*(Presented by Academician I. N. Nazarov, January 15, 1957)*

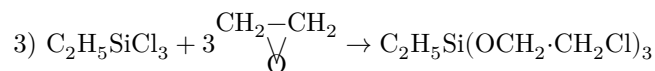
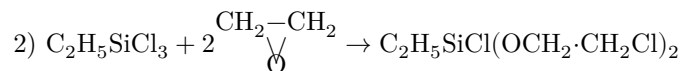
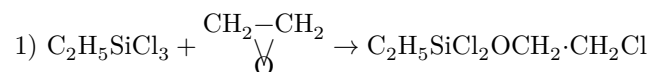
The reaction of  $\alpha$ -oxides of the ethylene series with silicon tetrachloride and alkyl(aryl)chlorosilanes has been partially described in the literature (<sup>1-5</sup>). In these cases, products of complete reaction of ethylene oxide were usually obtained both with silicon tetrachloride and with its substituted derivatives. The reactions, as is known, proceed according to the schemes:



Meanwhile, it is evidently possible to obtain not only products of complete reaction, but also a series of substances formed as a result of partial (incomplete) reaction of silicon tetrachloride and its substituted derivatives with ethylene oxide. This may be represented by the following equations for silicon tetrachloride:



The reaction of ethyltrichlorosilane with ethylene oxide may be expressed by the equations:



We have found conditions for the preparation and isolation of products of incomplete reaction of silicon tetrachloride and ethyltrichlorosilane with ethylene oxide. These products have not yet been described in the literature.

**Table 1**

Name of substance	Yield of chloroethoxysilanes, %	B.p., °C	$D_{20}^{20}$	C, % found	C, % calc.	H, % found	H, % calc.	Si, % found	Si, % calc.	Cl, % found	Cl, % calc.
2-Chloroethoxydichlorosilane	36	174 (760)	1.360	23.20	23.14	4.44	4.33	13.43	13.50	50.94	51.32
2-Chloroethoxydichlorosilane	36	174 (760)	1.360	23.40	23.14	4.53	4.33	13.80	13.50	50.61	51.32
Di-2-chloroethoxychlorosilane	28	162 (3)	1.280	28.60	28.64	5.19	5.15	11.14	11.13	42.99	42.31
Di-2-chloroethoxychlorosilane	28	162 (3)	1.280	28.81	28.64	5.28	5.15	11.36	11.13	43.17	42.31
Tri-2-chloroethoxysilane	35	123 (3)	1.350	32.48	32.49	5.76	5.76	9.41	9.48	36.52	35.88

Name of substance	Yield of chlorosilanes, %	B.p., °C	Formula	C, % found	C, % calc.	H, % found	H, % calc.	Si, % found	Si, % calc.	Cl, % found	Cl, % calc.
Tri-2-chloroethoxysilane (3)	80.00	22	$C_2H_5OCH_2CH_2Cl_3$	32.29	32.49	5.82	5.76	9.67	9.48	36.79	35.88
2-Chloroethoxytrichlorosilane (760)	60.00	163	$SiCl_3OCH_2CH_2Cl$	11.36	11.12	1.98	1.90	13.10	13.03	65.57	65.92
2-Chloroethoxytrichlorosilane (760)	60.00	163	$SiCl_3OCH_2CH_2Cl$	11.41	11.12	2.02	1.90	13.14	13.03	65.62	65.92
Di-2-chloroethoxydichlorosilane (760)	50.00	226	$SiCl_2(OCH_2CH_2Cl)_2$	18.86	18.62	3.15	3.05	10.82	10.68	54.56	54.98
Di-2-chloroethoxydichlorosilane (760)	50.00	226	$SiCl_2(OCH_2CH_2Cl)_2$	18.70	18.62	3.17	3.05	11.10	10.68	54.34	54.98
Tri-2-chloroethoxychlorosilane (3)	40.00	123	$SiCl(OCH_2CH_2Cl)_3$	23.98	23.75	4.02	3.97	9.33	9.4	46.77	46.99
Tri-2-chloroethoxychlorosilane (3)	40.00	123	$SiCl(OCH_2CH_2Cl)_3$	24.02	23.75	4.03	3.97	9.28	9.4	46.46	46.99
Tetra-2-chloroethoxysilane (3)	30.00	143	$Si(OCH_2CH_2Cl)_4$	27.91	28.04	4.61	4.61	8.16	8.09	41.62	41.01
Tetra-2-chloroethoxysilane (3)	30.00	143	$Si(OCH_2CH_2Cl)_4$	27.53	28.04	4.58	4.61	7.98	8.09	41.83	41.01

## Experimental Part

We shall consider the conditions for obtaining the products of the interaction of ethylene oxide with silicon tetrachloride and ethyltrichlorosilane using the preparation of 2-chloroethoxyethylchlorosilane as an example.

To 32.6 g (0.2 g-mol) of cooled (ice) ethyltrichlorosilane, b.p. 98-99° (760 mm)

and  $D_{20}^{20}$  1.2380, liquid ethylene oxide was added in portions, with stirring, until an increase in weight of 8.8 g (0.2 g-mol) was obtained. If the reaction did not begin at once, the reaction vessel was removed from the ice (the onset of the reaction can be observed from the rise in the temperature of the reaction mixture).

After completion of the reaction, the reaction mass was subjected to distillation. 15.8 g (44.13% of theory) of 2-chloroethoxyethylchlorosilane was isolated, b.p. 173–174° (760 mm),  $D_{20}^{20}$  1.2365.

Found, %: C 23.40; 23.20; H 4.44; 4.53; Si 13.43; 13.80; Cl 50.92; 51.32  
 $C_4H_9SiOCl_3$ . Calculated, %: C 23.14; H 4.33; Si 13.50; Cl 51.32

The remaining products were obtained by an analogous procedure. Some of their physicochemical properties are given in Table 1.

The products of the incomplete interaction of ethylene oxide with silicon tetrachloride and ethyltrichlorosilane are liquids with a sharp odor, fuming in air, and readily soluble in organic solvents.

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*Note: Figure translations are in progress. See original paper for figures.*

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