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Hiromu Murata

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The Raman Spectra of Ethoxychlorosilanes

HIROMU MURATA
The Osaka Municipal Technical Research Institute, Osaka, Japan
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THE Raman spectra of tetramethoxysilane and tetraethoxysilane for the determination of the four fundamental frequencies attributable to the SiO_4 group have been reported by several investigators.[1] I have already measured the Raman spectra of methoxychlorosilanes[2] and I shall now report on that of ethoxychlorosilanes. The samples were prepared as follows: Tetrachlorosilane was added slowly to vigorously stirred anhydrous ethanol, and after careful fractional distillation, they gave the following boiling point: $C_2H_5OSiCl_3$, 102°; $(C_2H_5O)_2SiCl_2$, 134°; $(C_2H_5O)_3SiCl$, 153°. The results for these compounds together with the data available for the two compounds $SiCl_4$ and $Si(OC_2H_5)_4$ are given in Table I. From the results obtained for methylchlorosilanes,[3] ethylchlorosilanes,[4] and methoxychlorosilanes,[2] assuming ethoxy groups as one particle, I have tentatively assigned the observed lines as shown in Table I, where *A* denotes totally symmetric, *B* antisymmetric, *E* twofold degenerate, and *F* threefold degenerate vibrations of the tetrahedral molecule, respectively.

[1] B. T. Thosar and R. N. Bapat, Z. Physik **109**, 472 (1938).
[2] H. Murata, J. Chem. Phys. **20**, 347 (1952).
[3] Shimanouchi, Tsuchiya, and Mikawa, J. Chem. Phys. **18**, 1306 (1950).
[4] Murata, Okawara, and Watase, J. Chem. Phys. **18**, 1308 (1950).

TABLE I. Raman spectra of ethoxychlorosilanes (cm^{-1}).

Modes of vibrations	$SiCl_4$	$C_2H_5OSiCl_3$	$(C_2H_5O)_2SiCl_2$	$(C_2H_5O)_3SiCl$	$(C_2H_5O)_4Si$
δ(Si−Cl)	E 150	E 171(8*s*)(*ek*)	A_1 ···		
			A_2 ···	E ···	E ···
δ(Si−OC_2H_5)	F_2 221	A_1 215(4*s*)(*ek*)	A_1 240(3*b*)(*e*)	A_1 290(2*b*)(*e*)	F_2 ···
		E 249(2*s*)(*ek*)	B_1 295(2*b*)(*ek*)	E ···	
			B_2 ···		
δ(C−C)		294(2*s*)(*ek*)	···	···	···
δ(O−C)		364(4*s*)(*e*)	399(2*b*)(*ek*)	435(2*b*)(*ek*)	···
ν(Si−Cl)	A 424	A_1 475(10*s*)(*ek*)	A_1 490(6*s*)(*ek*)	A_1 520(4*s*)(*ek*)	A_1 652
	F_2 608	E 603(3*b*)(*ek*)	B 598(2*s*)(*ek*)	A_1 695(3*b*)(*ek*)	F_2 782
ν(Si−OC_2H_5)		A_1 775(4*s*)(*ek*)	A_1 744(2*b*)(*ek*)	E 799(1*b*)(*ek*)	
			B 813(1*b*)(*e*)		
ν(C−C)		951(2*s*)(*ek*)	950(2*s*)(*ek*)	950(3*s*)(*ek*)	938
		995(2*s*)(*ek*)	992(2*s*)(*ek*)	997(3*s*)(*ek*)	
ν(O−C)		1092(3*s*)(*ek*)	1091(3*s*)(*ek*)	1090(3*s*)(*ek*)	1085
δ(C−H)		1294(3*s*)(*ek*)	1295(2*s*)(*ek*)	1291(2*s*)(*ek*)	1285
		1322(1*s*)(*ek*)	1325(1*s*)(*k*)	1324(2*s*)(*k*)	
		1347(2*s*)(*ek*)	1346(2*s*)(*e*)	1346(2*s*)(*e*)	
		1395(2*s*)(*ek*)	1391(2*s*)(*ek*)	1390(2*s*)(*ek*)	
		1446(3*s*)(*ek*)	1445(3*s*)(*ek*)	1445(3*s*)(*ek*)	1443
ν(C−H)					2776
			2866(4*s*)(*ek*)	2868(4*s*)(*ek*)	
		2899(3*s*)(*ek*)		2899(2*s*)(*ek*)	2883
		2936(9*s*)(*ek*)	2935(7*s*)(*ek*)	2935(6*s*)(*ek*)	
		2980(8*s*)(*ek*)	2980(6*s*)(*ek*)	2980(5*s*)(*ek*)	2995