



Electric and bond moments of some carbon, silicon and titanium organic compounds  
by Walter Katz

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree  
of Master of Science in Chemistry  
Montana State University  
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Abstract:

A further study of the dielectric and chemical properties of titanium-tetraethylate has been made. This compound forms aggregates in solution up to approximately a trimer, a type of association which is apparently not based upon hydrogen bonding but rather upon the coordination valence of titanium. X-ray diffractions of titanium-tetraethylate crystals could be used to determine whether this is actually true. The dipole moments of  $\text{Ti}(\text{OC}_2\text{H}_5)_4$ ,  $\text{Ti}(\text{OC}_3\text{H}_7)_4$ ,  $\text{Ti}(\text{OC}_4\text{H}_9)_4$ ,  $\text{TiCl}(\text{OC}_2\text{H}_5)_3$ ,  $\text{SiCl}(\text{OC}_2\text{H}_5)_3$  and  $\text{HC}(\text{OC}_2\text{H}_5)_3$  were determined in hexane solution at  $25^\circ\text{C}$  and found to be 1.58, 1.32, 1.04, 2.50, 1.75 and 0.7 Debye units respectively. The method used for the determination of the electric moments consisted of measuring the dielectric constants and specific volumes of dilute solutions of the compounds in hexane and extrapolating the resulting straight lines to infinite dilution. The slopes and intercepts were then used to calculate the molar polarisation from an equation derived by Halverstadt and Kumler (8). The electronic and atomic polarisations were obtained either from refractive index and density measurements of the pure compound or by measuring the refractive indices of dilute solutions of the compound in hexane solution and using the slope and intercept of the plot of the square of the refractive index against mole fraction in the Halverstadt and Kumler equation. The molar polarisations of titanium tetraethylate at low temperatures were corrected and the polarization plotted against  $1/T$ .

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Submitted to the Graduate Faculty  
in  
partial fulfillment of the requirements  
for the degree of  
Master of Science in Chemistry  
at  
Montana State College

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August 1949

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## I. ABSTRACT

A further study of the dielectric and chemical properties of titanium-tetraethylate has been made. This compound forms aggregates in solution up to approximately a trimer, a type of association which is apparently not based upon hydrogen bonding but rather upon the coordination valence of titanium. X-ray diffractions of titanium-tetraethylate crystals could be used to determine whether this is actually true. The dipole moments of  $Ti(OC_2H_5)_4$ ,  $Ti(OC_3H_7)_4$ ,  $Ti(OC_4H_9)_4$ ,  $TiCl(OC_2H_5)_3$ ,  $SiCl(OC_2H_5)_3$  and  $Hf(OC_2H_5)_4$  were determined in hexane solution at 25°C and found to be 1.58, 1.32, 1.08, 2.50, 1.75 and 0.7 Debye units respectively. The method used for the determination of the electric moments consisted of measuring the dielectric constants and specific volumes of dilute solutions of the compounds in hexane and extrapolating the resulting straight lines to infinite dilution. The slopes and intercepts were then used to calculate the molar polarization from an equation derived by Halverstadt and Kusler (8). The electronic and atomic polarizations were obtained either from refractive index and density measurements of the pure compound or by measuring the refractive indices of dilute solutions of the compound in hexane solution and using the slope and intercept of the plot of the square of the refractive index against mole fraction in the Halverstadt and Kusler equation. The molar polarizations of titanium tetraethylate at low temperatures were measured and the polarization plotted against  $1/T$ .















































































































