

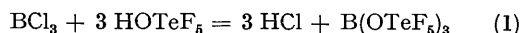
Boron Tris(pentafluoro-orthotellurate), $B(OTeF_5)_3$. Preparation and Lewis Acidity

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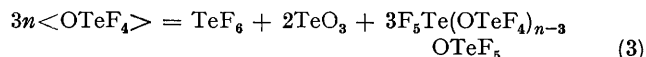
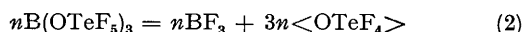
Summary The reaction of boron trichloride with pentafluoro-orthotelluric acid leads to the formation of $B(OTeF_5)_3$; its Lewis acid strength, determined calorimetrically, is comparable to that of boron trichloride.

BORON TRICHLORIDE reacts with pentafluoro-orthotelluric acid, HOTeF_5 ¹ at -80° according to equation (1). Boron tris(pentafluoro-orthotellurate), $\text{B}(\text{OTeF}_5)_3$ forms colourless,



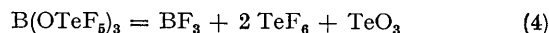
hexagonal crystals, m.p. 37° . The compound can be sublimed at room temperature *in vacuo* and easily hydrolyses to $\text{B}(\text{OH})_3$ and HOTeF_5 . It is soluble without reaction in CFCl_3 , nitrobenzene and related solvents. The mass spectrum shows M^+ and fragments arising from the successive dissociation of F_5TeO groups. The $56.4 \text{ MHz } ^{19}\text{F}$ n.m.r. spectrum is consistent with an AB_4 system, characteristic for F_5TeO compounds,² with $J_{\text{AB}} 179 \text{ Hz}$, $\delta +47.5 \text{ (A)}$, $+43.9 \text{ (B)}$ (relative to internal CFCl_3) and $R = 0.89$, calculated by the method of Harris and Packer;³ $\nu_{\text{BO}} 1330\text{s}$, $\nu_{\text{TeF}} 740\text{vs}$, 725vs , and 705s , and $\delta_{\text{BO}} 615\text{m}$, 430s (KBr, -195°).

Boron compounds like $\text{B}(\text{OCF}_3)_3$,⁴ $\text{B}(\text{SCF}_3)_3$,⁵ and $\text{B}(\text{OSO}_2\text{F})_3$ with fluorine atoms in the β -position to the boron are, in general, unstable above -20° towards fluoride shifts to vacant boron p -orbitals and formation of BF_3 . The thermal stability of $\text{B}(\text{OTeF}_5)_3$ up to 140° is therefore unexpected. Above 140° the compound decomposes to BF_3 , TeF_6 , TeO_3 , and a colourless, highly viscous liquid with an ill-defined boiling point above 250° according to equations (2) and (3).

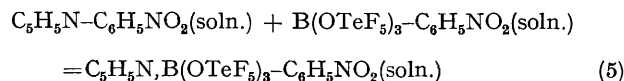


Preliminary molecular weight determinations suggest an average value of about 25 for n . $\text{F}_5\text{Te}(\text{OTeF}_4)_n\text{OTeF}_5$ can

therefore be looked upon as a modification of the so far unknown tellurium oxide tetrafluoride. Above 200° the chain length is gradually diminished down to $n = 0$ and $\text{F}_5\text{TeOTeF}_5$ ⁶ is formed. Simultaneously this compound decomposes to TeF_6 and $\alpha\text{-TeO}_3$. Above 350° the thermal decomposition of $\text{B}(\text{OTeF}_5)_3$ can be formulated according to equation (4).



$\text{B}(\text{OR})_3$ compounds are, in general, prevented by oxygen-boron back-donation from being as strong Lewis acids as the boron halides.⁷ Despite the bulky F_5TeO -groups, $\text{B}(\text{OTeF}_5)_3$ forms stable 1:1 adducts with pyridine, tetrahydropyran, and acetonitrile. We have calorimetrically determined the enthalpy of reaction (5) as being -30.0 kcal/mol . Since reference values of the boron halides for



the formation of pyridine adducts are known,⁸ the following order of Lewis acidity can be given: BF_3 25.0, $\text{B}(\text{OTeF}_5)_3$ 30.0, BCl_3 30.8, BBr_3 32.0 kcal/mol.

The surprisingly high acid strength of $\text{B}(\text{OTeF}_5)_3$ does not seem to be caused solely by the inductive effect of the F_5Te -groups but also by an electronic interaction between oxygen p -orbitals and vacant tellurium orbitals thus significantly reducing the oxygen-boron back-donation.

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