APPENDIX-I

Sanderson’s procedure to calculate the average electronegativity of anions present in the glasses

The Sanderson’s procedure to calculate the average electronegativity is as follows. The effective electronegativity ($\chi_{\text{eff}}$) of the anion of the type $\text{[M}_m\text{O}_n]^{-}$ is determined as given below.

a) The partial charge on the constituent atoms $\text{M (}\Delta_{\text{M}}\text{)}$ and $\text{O (}\Delta_{\text{O}}\text{)}$ are evaluated as

$$\Delta_{\text{M}} = (\chi_{\text{eff}} - \chi_{\text{M}})/\Delta \chi_{\text{M}} = \Delta_{\text{M}} \cdot \Delta \chi_{\text{M}} - \chi_{\text{eff}} - \chi_{\text{M}}$$

$$\Delta_{\text{O}} = (\chi_{\text{eff}} - \chi_{\text{O}})/\Delta \chi_{\text{O}} = \Delta_{\text{O}} \cdot \Delta \chi_{\text{O}} - \chi_{\text{eff}} - \chi_{\text{O}}$$

where $\Delta \chi_{\text{A}} = 1.56 \sqrt{\chi_{\text{A}}}$ (A = M or O) and $\chi_{\text{M}}, \chi_{\text{O}}$ are the electronegativities of M and O atoms respectively.

b) The net charge on the anion is equated to the sum of the partial charges on each atom present in the anionic group as

$$m \Delta_{\text{M}} + n \Delta_{\text{O}} = -\chi$$

solving the equation (1), (2) and (3) the $\chi_{\text{eff}}, \Delta_{\text{M}}$ and $\Delta_{\text{O}}$ are evaluated.

Example,

The effective electronegativity ($\chi_{\text{eff}}$) of $\text{[POO}_3\text{]}^{2-}$ is determined as follows. The electronegativities values used are 2.19 and 3.44 for phosphorous and oxygen respectively. Partial charge on phosphorous atom is given by,

$$\Delta_{\text{P}} = (\chi_{\text{eff}} - \chi_{\text{P}})/\Delta \chi_{\text{P}} = (\chi_{\text{eff}} - 2.19)/2.308$$

$$\chi_{\text{eff}} - 2.308 \Delta_{\text{P}} = 2.19$$
Partial charge on oxygen atom is given by,

\[ \Delta O = (\chi_{\text{eff}} - \chi(O)) / \Delta \chi_{O} = (\chi_{\text{eff}} - 3.44) / 2.893 \]

\[ \chi_{\text{eff}} - 2.893\Delta O = 3.44 \]  \hspace{1cm} (5)

Also from the charge neutral principle,

\[ \Delta p + 2.5\Delta O = 0 \]  \hspace{1cm} (6)

solving equations (4),(5) and (6),

\[ -5.77\Delta O + 2.19 = \chi_{\text{eff}} \]  \hspace{1cm} (7)

\[ 2.893\Delta O + 3.44 = \chi_{\text{eff}} \]  \hspace{1cm} (8)

solving equations (7) and (8),

\[ \chi_{\text{eff}} = 3.022 \]

\[ \Delta p = 0.36 \]

\[ \Delta O = -0.144 \]
LIST OF PUBLICATIONS BY THE AUTHOR

1. "D.C. Electronic conductivity studies on Zinc-Vanado-Phosphate Glasses".

2. "High pressure studies of Silver-Vanado-Phosphate Glasses".
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   International Conference on High Pressure Science and Technology, Nov.26-30,
   2001, National Physical Laboratory, New Delhi, India).

3. "D.C. Electronic studies of K$_2$O-PbO-V$_2$O$_5$ and CaO-PbO-V$_2$O$_5$ Glasses".
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   Guru Ghasidas University, Bilaspur, Chhattisgarh, India).

4. "Electrical Switching and High Pressure Properties of Silver-Phospho-Vanadate
   Glasses". - To be communicated.

5. "A.C. Conductivity and Dielectric Relaxation Studies of Silver-Phospho-
   Vanadate Glasses". - To be communicated.