FIGURE CAPTIONS
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Figure

1.1 Volume-temperature relationship of selenium in the liquid-crystal and liquid glass transition.

1.2.a Bonding in (a) Ge and (b) Se.
   (A) atomic states,
   (B) hybridized states,
   (C) molecular states,
   (D) states are broadened into bands in the solid.

1.2.b Bonding and antibonding states of various bands in relation to the energy bands of solid Ge and Se.

1.3.a The Mott - CFO model for covalent semiconductors having three dimensional cross-linked network structure.

1.3.b The Davis-Mott model showing a band of compensated levels near the middle of the gap.

1.3.c Density of states \( g(E) \) suggested by Marshall and Owen for \( \text{As}_2\text{Se}_3 \).

1.4.a Illustration of the transfer of an electron from one chain end to another creating two charged defects \( D^+ \) and \( D^- \). The reaction is assumed to be exothermic, the \( D^+ \) defect forming a three fold co-ordinated atom.

1.4.b The \( 2D^0 \rightarrow D^+ + D^- \) reaction on a configurational co-ordinate diagram.
Figure

1.5 Structure and energy of various defect configurations in a twofold co-ordinated material. Arrows represent the spin of electrons.

1.6 Dependences of (a) $\Delta E$ and $\Delta E_F$ and (b) $E_g$ on impurity concentration $N$.

2.1 DSC results for $\text{Se}_{80}\text{Te}_{20}$ and impurity doped samples.

2.2 DSC results for $\text{Se}_{80}\text{Te}_{10}\text{M}_{10}$ ($\text{M} = \text{Cd, In and Sb}$).

2.3 Rise of photocurrent with time in red light (660 nm) at 291 K after dark annealing for different times. The voltage applied across the sample was 5.0 V.

2.4 I-V characteristics in $\text{a-Se}_{80}\text{Te}_{20}$ at 291 K in the dark.

2.5 Cryostat used for the electrical measurements at different temperatures in vacuum.

3.1 Temperature dependence of dark current of $\text{a-Se}_{80}\text{Te}_{20}$ in both the states A and B.

3.2 Temperature dependence of steady state photoconductivity at various levels of illumination in state A.

3.3 Temperature dependence of steady state photoconductivity at various levels of illumination in state B.

3.4 Intensity dependence of steady state photoconductivity at various temperatures in state A.
Figure

3.5 Intensity dependence of steady state photoconductivity at various temperatures in state B.

3.6 Rise and decay of photocurrent at various temperatures at a particular intensity in state A. The light was switched off after 2 min.

3.7 Rise and decay of photocurrent at various temperatures at a particular intensity in state B. The light was switched off after 2 min.

3.8 Rise and decay of photocurrent at various levels of illumination at a particular temperature in state A. The light was switched off after 2 min.

3.9 Rise and decay of photocurrent at various levels of illumination at a particular temperature in state B. The light was switched off after 2 min.

3.10 Rise and decay of photocurrent at various illumination times at a particular temperature and intensity in state B.

3.11 Curves of $\ln I_{ph}$ vs time for the decay in the photocurrent at various temperatures and maximum intensity (1 A.U.) in red light (660 nm) in state B.

3.12 Curves of $\ln I_{ph}$ vs time for the decay in the photocurrent at various levels of illumination at a particular temperature (303 K) in state B.
Figure

3.13 Curves of \( \ln I_{\text{ph}} \) vs time for the decay in the photocurrent at 660 nm and 303 K for various illumination times at maximum intensity (1 A.U.) in state B.

3.14 Rise of photocurrent with time at different intensities in violet light (420 nm). The voltage applied across the sample was 1.5 V.

3.15 Rise of photocurrent with time at different intensities in red light (660 nm). The voltage applied across the sample was 1.5 V.

3.16 Variation in \( E \) and \( I_{\text{ph(st)}} \) with intensity of violet light (420 nm) at 303 K.

3.17 Variation in \( E \) and \( I_{\text{ph(st)}} \) with intensity of red light (660 nm) at 303 K.

3.18 Rise of photocurrent with time at different temperatures in violet light (420 nm). The voltage applied across the sample was 1.5 V.

3.19 Rise of photocurrent with time at different temperatures in red light (660 nm). The voltage applied across the sample was 1.5 V.

3.20 Variation in \( E \) and \( I_{\text{ph(st)}} \) with temperature and maximum intensity (1 A.U.) in violet (420 nm) light.

3.21 Variation in \( E \) and \( I_{\text{ph(st)}} \) with temperature at 303 K and maximum intensity (1 A.U.) in red (660 nm) light.
Figure

3.22 Rise in photocurrent with time at different temperatures in red light (660 nm). The voltage applied across the sample was 5.0 V.

3.23 Time dependence of $\tau_d$ for the decay curve at a particular temperature and intensity in state B.

3.24 Temperature dependence of $\tau_d$ ($t=20$ sec) in state B.

3.25 Intensity dependence of $\tau_d$ ($t=20$ sec) in state B.

3.26 Illumination time dependence of $\tau_d$ ($t=20$ sec) in state B.

3.27.a Density of states model

3.27.b Recombination transitions.

4.1 Temperature dependence of dark and photocurrent for a-Se$_{80}$Te$_{20}$ in states A and B.

4.2 Temperature dependence of dark current for a-Se$_{80}$Te$_{10}$Ag$_{10}$ in states A and B.

4.3 Temperature dependence of dark and photocurrent for a-Se$_{80}$Te$_{10}$Cd$_{10}$ in states A and B.

4.4 Temperature dependence of dark and photocurrent for a-Se$_{80}$Te$_{10}$In$_{10}$ in states A and B.

4.5 Temperature dependence of dark and photocurrent for a-Se$_{80}$Te$_{10}$Sb$_{10}$ in states A and B.

4.6 Intensity dependence of photocurrent at room temperature for various samples in states A and B.
Figure

4.7 Temperature dependence of photosensitivity \( \frac{I_{ph}}{I_d} \) for amorphous thin films of \( \text{Se}_{80}\text{Te}_{20} \) and \( \text{Se}_{80}\text{Te}_{10}\text{Cd}_{10} \) in states A and B.

4.8 Temperature dependence of photosensitivity \( \frac{I_{ph}}{I_d} \) for amorphous thin films of \( \text{Se}_{80}\text{Te}_{10}\text{In}_{10} \) and \( \text{Se}_{80}\text{Te}_{10}\text{Sb}_{10} \) in states A and B.

4.9 Rise and decay of photocurrent at various temperatures for amorphous thin films of \( \text{Se}_{80}\text{Te}_{20} \) in states A and B.

4.10 Rise and decay of photocurrent at various temperatures for amorphous thin films of \( \text{Se}_{80}\text{Te}_{10}\text{Cd}_{10} \) in states A and B.

4.11 Rise and decay of photocurrent at various temperatures for amorphous thin films of \( \text{Se}_{80}\text{Te}_{10}\text{In}_{10} \) in states A and B.

4.12 Rise and decay of photocurrent at various temperatures for amorphous thin films of \( \text{Se}_{80}\text{Te}_{10}\text{Sb}_{10} \) in states A and B.

4.13 Temperature dependence of photosensitivity for various samples in state A.

5.1 Temperature dependence of dark conductivity at various concentrations of Ag impurity. The inset shows the concentration dependence of dc conductivity at 300 K.
Figure

5.2 Temperature dependence of dark conductivity at various concentrations of Cd impurity. The inset shows the concentration dependence of dc conductivity at 300 K.

5.3 Temperature dependence of photoconductivity at various concentrations of Cd impurity. The inset shows the concentration dependence of photoconductivity at 300 K. The measurements have been made at an intensity (1 A.U.

5.4 Temperature dependence of photosensitivity ($\sigma_{ph}/\sigma_d$) at various concentrations of Cd impurity. The data of Figs 5.2 and 5.3 are used for these calculations.

5.5 Intensity dependence of photoconductivity at various concentrations of Cd impurity. The measurements have been made at 300 K.

5.6 Temperature dependence of dark conductivity at various concentrations of In impurity. The inset shows the concentration dependence of dc conductivity at 300 K.

5.7 Temperature dependence of photoconductivity at various concentrations of In impurity. The inset shows the concentration dependence of photoconductivity at 300 K. The measurements have been made at an intensity (1 A.U.

5.8 Temperature dependence of photosensitivity ($\sigma_{ph}/\sigma_d$) at various concentrations of In impurity. The data of Figs 5.6 and 5.7 are used for these calculations.
Figure

5.9 Intensity dependence of photoconductivity at various concentrations of In impurity. The measurements have been made at 300 K.

5.10 Temperature dependence of dark conductivity at various concentrations of Sb impurity. The inset shows the concentration dependence of dc conductivity at 300 K.

5.11 Temperature dependence of photoconductivity at various concentrations of Sb impurity. The inset shows the concentrations dependence of photoconductivity at 300 K. The measurements have been made at an intensity (1 A.U.).

5.12 Temperature dependence of photosensitivity ($\sigma_{ph}/\sigma_d$) at various concentrations of Sb impurity. The data of Figs 5.10 and 5.11 are used for these calculations.

5.13 Intensity dependence of photoconductivity at various concentrations of Cd impurity. The measurements have been made at 300 K.