Chapter - VI

Summary and Conclusions
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6.1 Summary

A systematic investigation of the influence of tin oxide on dielectric properties and spectroscopic properties of Li$_2$O–PbO–P$_2$O$_5$ glasses and photoluminescence spectra of Sn$^{2+}$–Er$^{3+}$ and Sn$^{2+}$–Gd$^{3+}$ co-doped Li$_2$O–PbO–P$_2$O$_5$ glasses have been carried out.

The compositions of the samples used in the present study are:

1. 20 Li$_2$O–20PbO–(60–x)P$_2$O$_5$: x SnO$_2$,
2. 20 Li$_2$O–20PbO–(59–x)P$_2$O$_5$–1.0Er$_2$O$_3$: x SnO$_2$,
3. 20 Li$_2$O–20PbO–(59–x)P$_2$O$_5$–1.0Gd$_2$O$_3$: x SnO$_2$

with x=0, 1.0, 3.0, 5.0, 7.0

The glasses were prepared by the usual melting, quenching and subsequent annealing techniques.

The following studies were made:

1. Dielectric properties, ac and dc conductivity studies
2. Optical absorption spectra
3. ESR spectra of Gd$^{3+}$ doped glasses
4. Infrared spectra
5. Photoluminescence spectra
The following measurements were taken:

1) Dielectric properties were obtained by measuring 4294A Agilent precision an impedance analyzer over a frequency range from 100 Hz to 1 MHz and in temperature range from 200 to 370 K. The temperature was controlled to an accuracy of ± 0.5 K.

2) Optical absorption in the UV, visible and NIR regions at room temperature.

3) Electron spin resonance spectra at room temperature for Gd$_2$O$_3$ doped glasses at room temperature.

4) Infrared spectra of all these glasses in the range 400-1600 cm$^{-1}$.

5) Photoluminescence spectra of the rare earth doped glasses in the UV and visible regions at room temperature.

6.2 Conclusions

6.2(a) The main conclusions drawn from the results of above studies on SnO$_2$ doped glasses are summarized below:

1. **Dielectric constant**, $\varepsilon'(\omega)$, of Li$_2$O–PbO–P$_2$O$_5$–SnO$_2$ glasses at higher frequency approaches a constant value, $\varepsilon'_\infty(\omega)$, which results in rapid polarization processes occurring in the glasses under applied field. With decreasing frequency dielectric constant reaches higher value, $\varepsilon'_s(\omega)$. 