CHAPTER 6 – Conclusions

In this chapter conclusions are drawn from the present investigations are summarized.

Conclusions/summary:

It can be concluded from the results and discussions about the present NASSICON systems as following;

1) From X-ray diffraction (XRD), it concluded that doping of trivalent cations like Y^{3+}, Ga^{3+} and Sc^{3+} in parent system LTP and LATP – the rhombohedral ($R\bar{3}c$) structure is retained. Secondary phases like YPO_4, $GaPO_4$ and $ScPO_4$ are detected. The intensity of the peaks corresponding to these compounds increases as the doping concentration increases.
2) It is ascribed that with doping, the density of the samples increases. And the samples of yttrium series when heat treated, the density of the samples further increases. The increase in grain boundary conductivity and density suggest that the enhancement in the grain contacts.
3) The SEM micrographs suggest the formation of better linkages between grains which are glassy in nature.
4) The increase in content of dopant is also confirmed by EDS analysis it.
5) The conductivity of doped samples is one order less than the parent LATP system. It is confirmed that the parent system LATP possesses higher conductivity than that of doped samples. The dopant cations Y^{3+}, Sc^{3+} and Ga^{3+} have larger ionic radii compared to Al^{3+} and Ti^{4+}. Secondary phases like YPO_4, $GaPO_4$ and $ScPO_4$ are formed in the samples near the grain boundary and increase with doping concentration. These phases hinder the transport of Li^+ ions at grain boundary. But with heat treatment, the yttrium phases are segregated towards grain boundary and the grain boundary structure is modified resulting in to the increase in the grain boundary conductivity for such samples with higher yttrium content.

6) The impedance and /or the Nyquist plots confirm the presence of space charge zones near/at the grain boundary.
7) With the increase in dopant concentration and temperature, relaxation peaks shift towards the higher frequency side.
8) The peak width decreases with temperature and concentration in modulus curves attributing to non Debye type nature for these NASSICON type systems.

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