CHAPTER 5

Conclusion

5.1 Conclusion

In this research, samples of $LiCo_xNi_{1-x}O_2$ ($0<x<1$) materials were prepared. The materials were prepared using the sol-gel technique. Tartaric acid was used as gelating agent, which helps in bringing metal ions together and act as a fuel for the formation of the compound. pH was maintained at 4.5 to 5.5. The sol was evaporated at 120°C to form the gel precursors.

The precursors were then heated at 400°C and 800°C. FT - IR was carried out to check the purity of the material. Impurities such tartrates, hydroxy tartrates, carbonates were still present, even after heating precursors at 800°C for five hours. However, the intensity of peaks was less at higher temperature due to reduction in amount of impurities. Pure $LiNiO_2$ was obtained when calcination was carried out at 800°C for fourteen hours. XRD pattern showed sharper peaks, when samples were calcined at higher temperature. This shows increase in crystalline phase of sample materials. Intercalation properties of the materials were studied, using cyclic voltammetry. The presence of redox loops in the voltammogram shows that lithium ion diffuses into the sample material and undergoes intercalation and de-intercalation. Since $LiNiO_2$, which was calcined at 800°C for fourteen hours had the highest purity and crystallinity, it was used in battery fabrication. The charge/discharge curve for the cell with the cell configuration $LiNiO_2$/electrolyte/carbon shows that during charging lithium ion intercalates with carbon and during discharge the lithium ion de-intercalates and rocks back to the cathode.

It can be concluded that all four materials are suitable for making batteries.

5.1 Suggestions for future work.

It is suggested that the materials be calcined at higher temperatures and longer period, say 900°C for 15 hours. This is important, as intercalation and de-intercalation of lithium ions depends on the crystallinity of the material.

It is also important to run many cycles on the prepared materials. If the material is stable, the cyclic voltammogram will have the same trace for greater number of cycles.

To check the proposed phenomenon, that lithium ions intercalate at different sites at higher temperatures, it will be suggested that the experiment be carried out at temperatures higher than 60°C and use cathode materials with different crystalline structure (e.g. $LiMn_2O_4$).