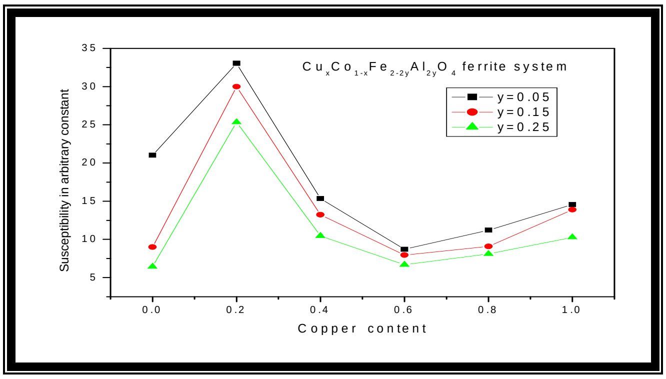

Figure 7 (a): Variation of A. C. susceptibility with copper and aluminium content at room temperature

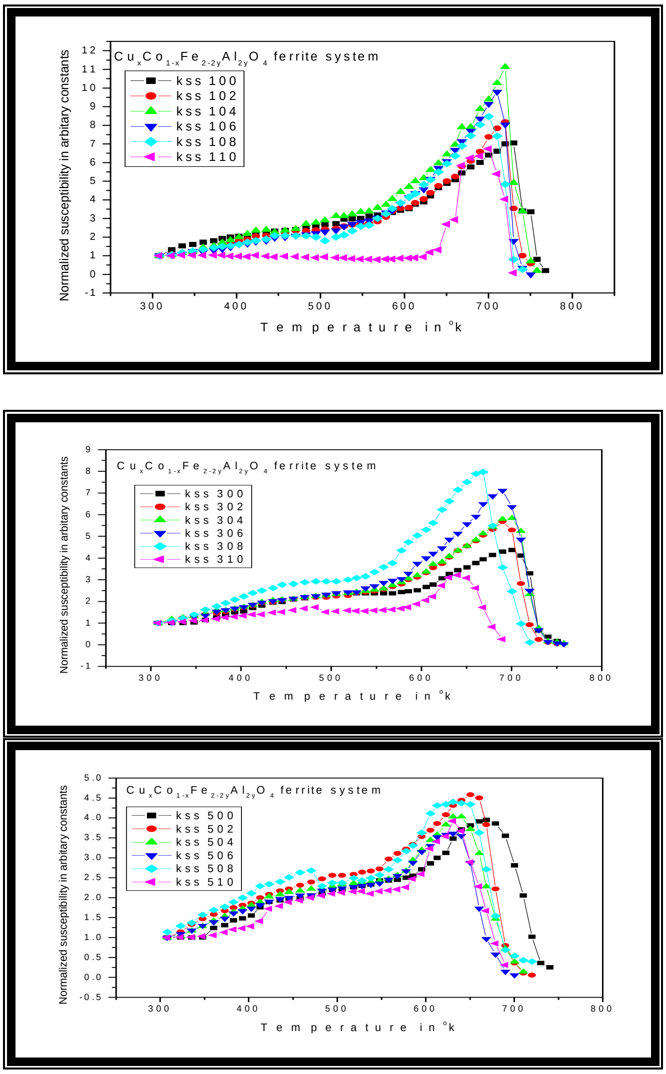

Figure 7 (b): Variation of A. C. susceptibility with copper and aluminium content at various temperatures for $Cu_xCo_{1-x}Fe_{2-2y}Al_{2y}O_4$ ferrite system

The susceptibility is measured at room temperature then susceptibility is found increasing up to 20 % of copper content and thereafter decreases [Fig.7(a)]. The susceptibility is measured at various temperature [Fig.7(b)], the compositions was shown gradual decrease in normalized susceptibility with temperature suggest that they exhibit super paramagnetic (SP) structure having fine particles. The susceptibility is decreases and Curie temperature also shifts towards minimum value as copper as well as aluminum content increases.

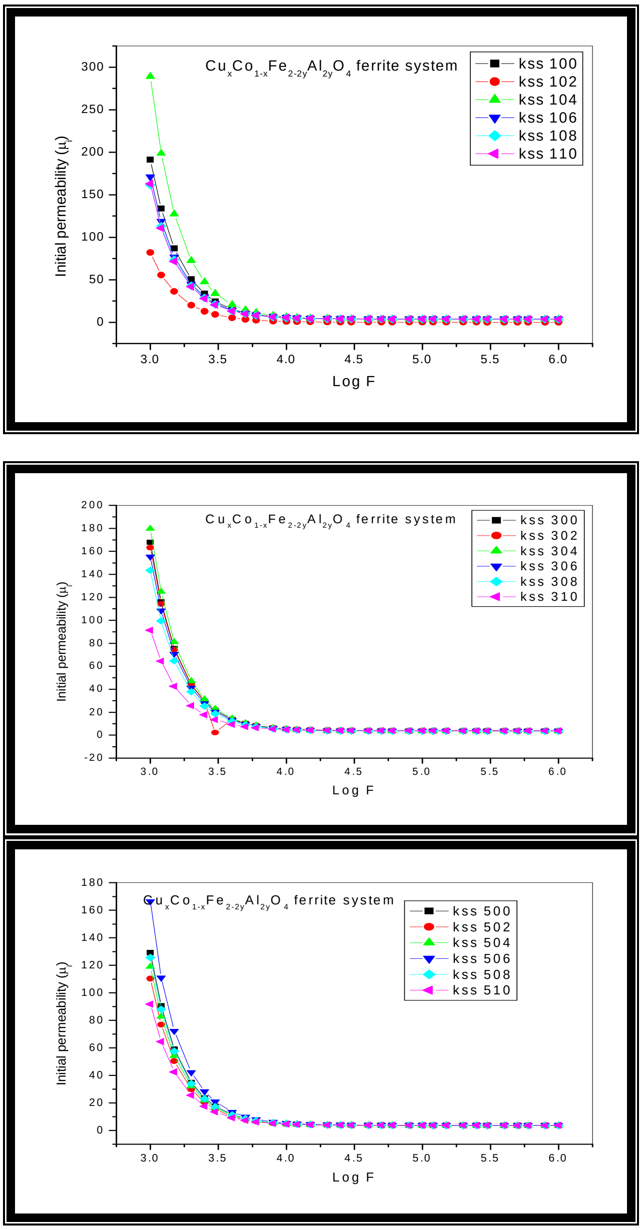

Figure 8: Variation of initial permeability with frequency for $Cu_xCo_{1-x}Fe_{2-2y}Al_{2y}O_4$ ferrite system

The variation of initial permeability as a function of frequency depicts the dispersion of initial permeability up to 1 KHz and beyond that it remains frequency independent. This low frequency dispersion in μi is attributed to domain wall displacement. The absence of low frequency resonance indicates that there is no domain wall motion. Thus, the low frequency dispersion in the ferrite compositions is only due to domain wall displacement. Initial permeability decreases with increases the copper content as well as aluminum content (Fig.8).

Figure 9 shows, variation of e.m.u with temperature and from this graph calculated the curie temperature. From the figure 10, it is found that Curie temperature of the compositions goes on decreases with increase in copper as well as aluminum content. It was rather expected because addition of copper replaces Fe^{3+} to B-site which reduces the population of Fe^{3+} on A-site and hence A-site becomes magnetically weak, results in the decrease in A-B interaction. The Curie temperatures are determined by drawing tangent to the paramagnetic tail on the temperature axis. Similar type of paramagnetic tail and Curie temperatures determination has been reported [16, 17].

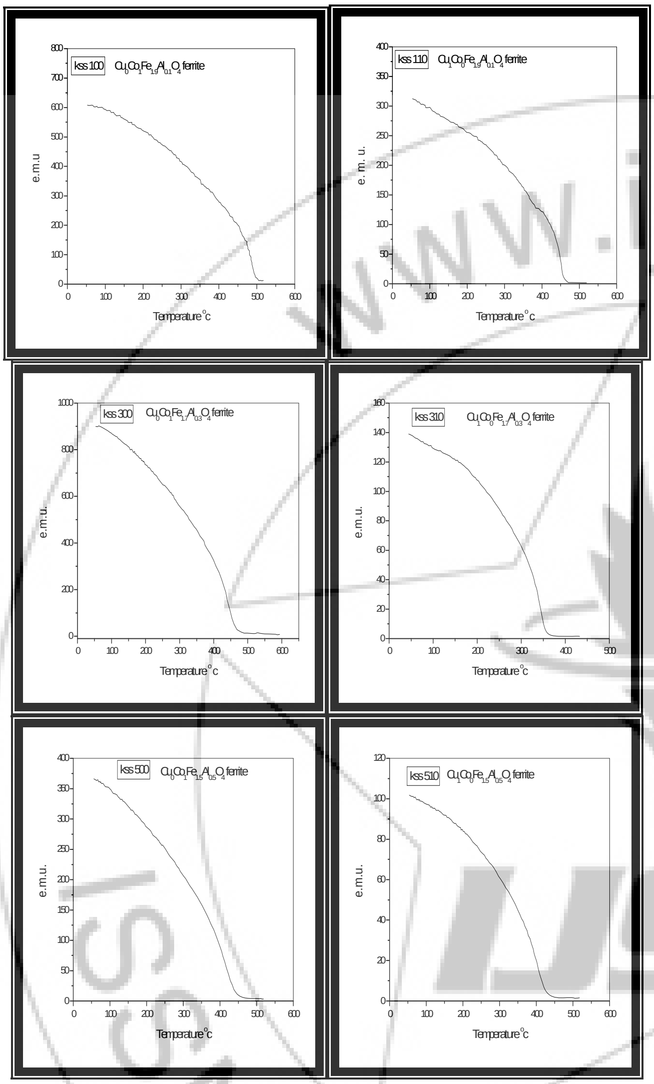

Figure 9: The curie temperatures for $Cu_xCo_{1-x}Fe_{2-2y}$ Al_{2y} O_4 ferrite system

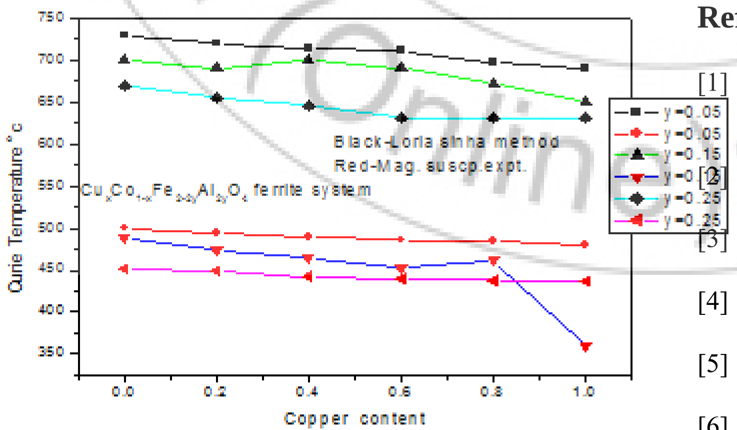

Figure 10: Variation of curie temperature with copper and aluminium content for $Cu_xCo_{1-x}Fe_{2-2y}$ Al_{2y} O_4 ferrite system

Curie temperature is the peculiar character of the ferromagnetic / ferri-magnetic materials. Curie temperature is the temperature at which it undergoes the phase transition from Ferro / Ferri-magnetic to paramagnetic state. The magnetic material shows spontaneous magnetization below its Curie point and no magnetization above the Curie temperature. In ferrites, Curie temperature is proportional to number of active magnetic linkages. It is affected by A-B distance and A-O-B angle. A-B interaction depends upon these distances. As these distance increases, Curie temperature decrease as suggested by Gorter and Neel [18-19] Curie temperature depends upon the Fe^{3+} ions participating in A-B interaction. When Fe^{3+} ions concentration per molecular formula unit is decreased, then Curie temperature decreased. The behaviour of Curie temperature in aluminium doped copper cobalt ferrite found decrease with concentration of aluminium content indicting the reduction in ferri-magnetic behaviour.

4. Conclusion

Copper cobalt ferrite is partially inverse cubic spinel ferrite. Addition of Al^{3+} ions replaces Fe^{3+} on (B) site resulting in increase of lattice constant a, decrease in ionic radii(R_A) and bond length(O-A). The lattice constant obtained from XRD data shows non-linear behaviour. The coercivity (Hc), magnetic moment (n_B), Remenent magnetization (Mr) and saturation magnetization (Ms) with copper and aluminum content goes on decreasing. The initial permeability decreases with increase in frequency. The A. C. susceptibility goes on decreasing with copper and aluminum content. The Curie temperature of copper cobalt ferrite decreases with aluminum content.

5. Future Scope

In this communication our aim was to study the effect of Aluminum on electric and magnetic properties of mixed Copper-Cobalt ferrite. Micro-structure of ferrites depends up on preparation technique. There is a scope to reduce the particle size by adopting a preparation technique like wet chemical precipitation method, sol-gel method etc and see the interesting results.

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