Preparation of painting material of Li-Ni ferrite

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The Li-Ni Nano ferrite samples with the structure $Li_{0.5-0.5x}Ni_xFe_{2.5-0.5x}O_4$ was prepared by hydrothermal method. They prepared two sets, from metal chlorides, and ferrous sulfate with NaOH. In each set, the variation of (x) was 0, 0.1, 0.3, to 1.0. The samples were without and with adding Fe^{+2}. The ratio of Fe^{+3}/Fe^{+2} was kept at 1.7. The preparation temperature was 155^0C and pH-value was equal to 11. The samples showed spinel ferrite structure beyond x=0.3 for set one and pure phase in 0.3 by using Fe^{+2}. Lattice constant of set two was a little lower than set one and both were little lower than theoretical. The crystallite size gets minimum at x=0.5 for set one and roughly maximum at x=0 for set two. FTIR spectrums tetrahedral showed peak shift to higher frequency with increasing Ni^{+2} concentration. Particles shapes were: rods (often hematite) average diameter 40 nm, spherical (nanocube ferrite in origin) sizing around 20 nm. M-H Loops had S-shape like to superparamagnetic one. Generally, the prepared samples have lower coercivety, higher saturation magnetization. Both sets gave maximum susceptibility at x=0.5. These results explained based on composition, cations distribution, cation interactions and particle size. Resonance microwave absorption by using FMR test showed that the maximum imaginary susceptibility χ'' is at x=0.5 for set one besides high values of 0.7 and 0.9, with largest line width of about 950 G at x=0.7. Set two showed maximum absorption (χ'') and line width at x=0.9. The powder mixed with Novalac epoxy by 7.93% wt. The FMR test with no field showed that high absorption to microwave field for frequencies larger than 19 GHz. The explanation of that set two samples has larger absorption than the set one that based on hopping conductivity and magnetic parameters (Ms and Hc) variation. Transmission line method by using VNA in X-band and Ku-band showed that return (reflection) RL loss got minimum at x=0.3 in for set one in X-band whereas that happen at x=0.3 and x=0.5 for set two. Adding Fe^{+2} lowered the minimum by a factor of more than 1.5. The insertion losses IL in X-band ranging from -4.5 to -7 dB, RL and IL in Ku-band have same behavior but their values were lower. RL got minimum at x=0.5 with value of about near to -18dB whereas it was around -12dB by adding Fe^{+2}, the average IL in Ku-band was about -6dB.

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