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Magnetic and Dielectric properties of La3+ substituted Co2Z hexaferrites for anti-electromagnetic shielding, anti-radar interference and electronic digital data storage devices

Co2Z hexaferrites (Ba3-xLaxCo2Fe24O41 with x = 0.0, 0.15 and 0.25) were synthesized by using sol-gel method. X-ray diffraction patterns confirmed the single Z-type phase formation with x = 0.0 to 0.25. The lattice parameters were found to increase with La substituting. The magnetic measurements were carried out using the Vibrating Sample Magnetometer (VSM). The saturation magnetization (Ms), magnetic coercive force (Hc) and retentivity (Mr). The increasing value of Ms directly improved the cutoff frequency and Snoek's operating conditions. The increasing of Hc suggested electronic digital data storage safely in magnetic material. The amplitude of the dielectric constant ε' of the material. This implied that the material is capable to absorb electromagnetic radiation or interference signals of the desired objects.

The real impedance (Z') decreased with increasing both frequency and temperature. The decreasing tendency of the graphs indicated the ac conduction nature in the material. The conduction mechanism enhanced with increasing temperature. At high frequency domain all curves were merged to each other, may be due to release of space charges. The impedance loss profiles showed relaxation peak shifts to higher frequency side with broadening and lowering amplitude of the Z". This conveyed that the electric response is thermally activated and probably due to the existence of space charge along the grain boundaries. The peak shift indicated the time of the relaxation increased with increasing temperature. All curves were merging after 1MHz indicates a possible liberation of space charge. The broadening of Z" peaks started with the increasing temperature at higher frequency side, suggested multiple relaxation time scale for the charge carriers.

The impedance spectroscopy terms (Dielectric constant, dielectric loss, real and imaginary impedances) of La3+ substituted Co2Z hexaferrite indicates, this material has higher internal potential barrier to absorb the electromagnetic spectrum and interference phenomena from the surface of the objects. Therefore, La substituted Z-type can be used in defense and the aircraft as anti-coating of electromagnetic radiation and interference for hidden its position. The higher value of Hc suggests the digital data can be stored in the miniaturized pen drive or Compact Disc (CD).

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