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## Synthesis and characterization of yittrium doped Co nano ferrite for biomedical applications

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Yittrium doped Co nano ferrites, $CoFe_{2-x}$ $O^4$, where x varies as 0.05, 0.1, 0.15 and 0.2 were successfully synthesized using solution combustion route. X-ray diffractogram confirm the Spinel structure fornation and neutron diffraction analysis reveals the magnetic structure. The magnetic parameters obtained from VSM, namely coercivity and residual magnetisation were discussed in the light of results obtained from structure analysis. The electrical resistivity measurements confirmed polaron conduction mechanism in these ferrites. The dielectric measurements, and the impedance analysis have shown interesting results and are explained using Koop's theory. Some peculiar results pertaining to loss tangent are explained proposing new models.

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## Development of air plasma thermal spray coating for thermal barrier coating and oxidation resistance applications on Ni-base super alloys

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Aerospace gas turbine engines are now designed such that the heat resistant super alloys operate at temperature very close to their melting, so current strategies for performance improvement are centered on thermal barrier coatings. Lower thermal conductivities lead to temperature reductions at the substrate/bond coat interface which slows the rate of the thermally induced failure mechanisms. Alternatively, lower thermal conductivity TBC layers might allow designers to reduce the TBC thickness there by decreasing the significant centrifugal load that the mass of the TBC imposes on the rotating turbine engine components. One approach to improve TBC system is to optimize the pore morphologies in order to reduce the thermal conductivity while still retaining high in-plane compliance. The second approach to improve TBC system performance is to optimize the surface microstructure, surface densification, phase structures mechanical characteristic, chemical structure, and thermo-physical properties. The main focus of this work is to study the influence of AlPO4 (and laser)-sealed $ZrO_2$-MgO coatings on thermal barrier coating system comprised of zirconia stabilized with magnesia top coat to predict the best improvement of TBC system and to optimize the surface microstructure, surface densification, phase structures, mechanical characteristic, chemical structure, and thermo-physical properties as well as their properties with those obtained using reference techniques. Thermal expansion studies were used to study the high temperature stability of the different coatings (reference and modified coatings) structures. As low thermal conductivity is one of the most important features of TBC, thermal diffusivity and specific heat measurements were carried out. Also the mechanical measurements (e.g., micro-hardness, tensile bond strength, young's modulus), phase analyses using XRD and chemical analysis using Electron Dispersive X-ray (EDX) for elemental analysis in scanning microscopy studies.

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