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Super strong nano-composite materials for bunkers & command posts in army

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Soldiers in battle front need overhead protection, while facing the enemy directly or indirectly. Bunkers and command posts either made of stones, concrete, bricks, steel or mere earth provides some protection but are not fool proof which occasionally crumble at crucial decisive moments causing causalities and damage. To provide protection, high strength nano-composite material for bunker and command post construction is an ideal answer. Steel and polymer based nano-composites are useful for various protective systems like helmets, body and vehicle armours against small arm ammunition. This study is regarding conduct of synthesization of multi-walled carbon nano-tubes reinforced polymer and steel nano-composites using nano-powder processing technique; characterization and study of mechanical properties of the new nano-composites and their effectiveness trials in firing ranges. The developed nano-composite materials from stainless steel and polymer by using multi-walled carbon nanotubes (MWCNT) are found to be many times stronger because of their strengths 10-100 times higher than the strongest steel. Grain refinement down to 100 nm of stainless steel and dispersion of nanostructured materials into the steel matrix increase superbly their mechanical properties. The refined microstructure of 326L stainless steel in the treated layer led to increase in hardness, strength, and wear resistance. Nano-composites from steel and polymers are developed as stronger materials to withstand the impact of bullets and bombs. Polymers or steel are melted in a crucible/mould of desired shape of bunker, command posts walls, helmets, bullet-proof jackets, etc can be developed easily. Carbon nanotubes dispersed in the melted polymer and steel followed by quenching up to room temperature provide an easiest technique to yield the nano-composites materials. Nano-composites dispersed with carbon nanotubes (diameter 25-50 nm) in polymers and steel enhance tensile strength, hardness and higher temperature resistance. Stronger polymers also provide observation from inside for the purpose of observation and fire. The properties imparted by nanoparticles are varied and focus particularly on strengthening the tensile strength, hardness and barrier properties to temperature, gases and liquids as well as the possible improvement of fire behavior.

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Structural and dielectric studies of nickel substituted lithium nano ferrites by low temperature combustion method

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Nano crystalline spinel ferrites having compositional formula $Li_{0.5-0.5x}Ni_xFe_{2.5-0.5x}O_4$ (where x=0.0 to 1.0 with step of 0.2) have been prepared by non conventional low temperature citrate gel auto combustion method. The synthesized ferrite powders were sintered at 500°C for 4 hours. The single phase cubic structure of the prepared samples was confirmed by X-ray diffraction analysis. By increasing in the Ni doping in the Li-Ni ferrites, the variations in the structural parameters like lattice parameter, crystallite size and X-ray density etc, were observed. The dielectric parameters like dielctric constant, dielectric loss tangent (tanδ) and AC conductivity of the prepared samples were measured by using Agilent E4980A precession LCR meter at room temperature in the frequency range 20-2 MHz. The dielctric constant (ε'), dielectric loss tangent (tanδ) and AC conductivity of the prepared samples shows a normal dielectric behaviour of ferrites with frequency which indicates the dielectric dispersion is due to the hoping of electrons between the Fe^{+2} and Fe^{+3} ions. A qualitative explanation was given for composition and frequency dependent dielectrical properties of the prepared Li-Ni ferrite samples.

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