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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 casualties 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), is found to be many times stronger because the strength is 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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Enhancing thermal property of fluids with nanoparticles

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Fluids are often used as heat carriers in heat transfer equipment. Examples of important uses of heat transfer fluids include cooling systems in the transportation industry, heating and cooling systems in buildings, heating and cooling systems in petrochemical, textile, pulp and paper, chemical, food, and other processing plants. In all of these applications, the thermal conductivity of heat transfer fluids plays a vital role in the development of energy-efficient heat transfer equipment. With an increasing global competition, industries have a strong need to develop advanced heat transfer fluids with significantly higher thermal conductivities than are presently available. In this present study, enhanced mixed convection and heat transfer by nanofluid in ventilated square enclosure including two heat sources was investigated numerically. The governing equations are solved using a second order accurate finite volume approach with a staggered grid system. The classical projection method is used to handle the velocity-pressure coupling. The effects of monitoring parameters, namely, Richardson number, Reynolds number and solid volume fraction on the streamline and isotherm contours as well as average Nusselt number along the two heat sources are carried out and discussed. The results show that by adding the nanoparticles to base fluid and increasing both Reynolds and Richardson number the heat transfer rate is enhanced. It is also found, regardless of the Richardson number, Reynolds number and the solid volume fraction of nanoparticles, the highest heat transfer enhancement occurs at the left heat source surface.

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