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IMPROVEMENT OF MECHANICAL PROPERTIES OF CAST ZA-27 TREATED WITH ADDITION OF NANO ZINC OXIDE

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An investigation has been carried out on making and characterization of ZA-27 alloy treated with zinc oxide nanoparticles. This was aimed at developing high performance ZA-27 alloy with low density. The particle size and morphology of the zinc oxide (ZnO) nanoparticles were investigated by Transmission Electron Microscope (TEM) and the elemental composition was obtained from Energy Dispersive Spectroscopy (EDS) attached to TEM and x-ray fluorescence spectroscopy (XRF). ZA-27 nano alloy samples were developed using 0, 1, 2, 3, 4 and 5 wt% of ZnO nanoparticles by induction furnace casting technique. Mechanical properties and Microstructural examination were used to characterize the composite samples produced. The results show that hardness and ultimate tensile strength of the composite samples increased progressively with increase in weight percentage of ZnO nanoparticles. Increase in ultimate tensile strength (UTS) of 10.2%, 21.1%, 22.3%, 35.5%, 33.4% and increase in hardness value of 8.2%, 14.8%, 21.7%, 27.9%, 27.1% were observed for Zn -27 alloy treated with 1 wt%, 2 wt%, 3 wt%, 4 wt%, and 5 wt% ZnO nanoparticles respectively in comparison with untreated alloy. It was generally observed that alloy containing 4 wt% of treated has the highest tensile strength and hardness values. However, the fracture toughness and percent elongation of the composites samples slightly decreased with increase in ZnO nanoparticles content. Results obtained from the Microstructural examination using optical microscope and Scanning Electron Microscope (SEM) show that the nanoparticles were well dispersed in the ZA-27 alloy.

CAVITATION: A TECHNOLOGICAL SOLUTION FOR THE GENERATION OF PHARMACEUTICAL NANO-EMULSIONS AND FUNCTIONALISED CARBON NANOMATERIALS

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An increasing number of newly developed drugs are sparingly soluble in water and are often also insoluble in organic solvents, and thus the formulation of these drugs is a key impediment to their clinical application. Owing to their exceedingly low solubility, these drugs frequently also possess poor bioavailability. Common ways of solving this problem include the use of solubilizers, cyclodextrins, and mixtures of solvents. But these methods have various shortcomings. An alternative in attempts to overcome the obstacles existing with these methods is the formulation of drugs as nanoemulsions induced by simple processing as any new simple process technology in the generation of nanoemulsions will have direct impact and great promise for the future of cosmetics, diagnostics, drug therapies and biotechnologies. Cavitation offers a simple way to generate various pharmaceutical nanoemulsions. Besides nanoemulsions, cavitation is also very powerful in the generation of functionalised carbon nanomaterials to be employed potentially in the pharmaceutical area. Where, cavitation seems to be promising in terms of reducing the time, avoiding the use of toxic or complicated agents, reducing the number of stabilisers/surfactants and reducing the separation/purification problems. In case of graphene, it results in an exceptionally stable dispersion. Whereas, for CNTs cavitation renders them dispersing into water and stabilised them longer. For fullerene, it enhances the number of hydroxyl groups on the surface which in turn increased the solubility in water. Overall, employing cavitation provides a facile strategy to overcome the inherent disadvantages existing with the traditional methods in the generation of nanoemulsions and in the functionalisation and dispersion of carbon nanomaterials, the resultant of which are very useful in drug delivery and in biosensing.