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A biodegradable Mg-1Ca-2Zn-1TCP nanocomposite fabricated by high shear solidification and ECAE

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A biodegradable magnesium matrix and β-tricalcium phosphate (β-TCP) nano-particles reinforced composite Mg-2Zn-0.5Ca-1beta-TCP (wt%) was fabricated for biomedical applications by high shear solidification (HSS) combined with equal channel angular extrusion (ECAE). The HSS resulted in a fine and uniform grain structure with β-TCP particles globally uniformly distributed in the matrix in aggregates of 2-25mm in size. The as-cast microstructure was replaced by a refined deformation microstructure after ECAE processing at 300°C. During ECAE the β-TCP particle aggregates were broken into smaller ones or dispersed, forming a dispersoid of individual β-TCP particles in the matrix. ECAE processing increased both the hardness and the corrosion resistance of the material. The dispersed]-TCP particles were considered to be largely responsible for the improved corrosion resistance. The composite was characterized in terms of microstructural evolution during fabrication, hardness and electrochemical performance during polarization and immersion tests in a simulated body fluid. The benefits of both HSS and ECAE for refining microstructure and improving particle distribution and the characteristic features of the corrosion behaviour for the material are discussed in the paper.

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Production of spear grass' nano cellulose based gel fuel for domestic heating

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Spear grass found abundantly in the wild in the country was collected from the premises of University of Agriculture Makurdi, Benue State. Nano cellulose material was extracted from the grass and used as a gelling agent in the production of gel fuel the gelling capacity, quantity and physicochemical properties of the nano material was determined using X-ray diffraction (XRD) and X-Ray fluorescence (XRF). Ultraviolet and Visible Absorption Spectroscopy (UV-Vis) were used to determine the Nano particle size nature of the cellulose while Fourier Transform Infrared Spectroscopy(FTIR) was used to ascertain the degree of purity of extracted Nano cellulose material that is devoid of contaminants like lignin, hemicellulose and other extractive. Scanning Electron Microscope (SEM) was also conducted on the sample for surface morphology. Thermogravimetric-differential scanning calorimetry (TGA-DSC) is used for thermal stability of the sample. The use of the nano cellulose from the spear grass in gelling of the fuel further reduces the overall cost of producing the fuel imparting an economically cheaper alternative heating material to fossil kerosene. The absence of characteristic peaks at wavelength of 1734 and 1509 cm^{1} for lignin, hemicellulose indicates the effective extraction of those contaminants from the spear grass material. The XRD result as shown in the chart confirms the nano particles size of the cellulose material obtained while the interpreted UV-vis support the nano particle size.

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