J Material Sci Eng 2016, 5:6(Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.044

Shield production of fiber-reinforced polymer composites with HMC method

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Fiber-reinforced polymer composites have played a dominant role for a long time in a variety of applications for their high specific strength and modulus. Especially, composites are classified via production types such as pultrision, wet lay up, spray up and molding. In this study, E-glass/resin composite laminates using powder-bond chopped-strand mat and fibers were fabricated using sheet molding compound technique. In preparation of the sheet molding compounds, unsaturated polyester, vinyl ester and epoxy were chosen as resin types. Unsaturated polyester and vinyl ester resins, which are very widely used in industry, were investigated in this study. The composites were characterized as high mechanical strength compound (HMC). An experimental investigation was carried out to determine the mechanical, physical and ballistic performance of HMC. The measured mechanical properties of HMC produced with 2400 text hundred wick on 450 g/m^2 powder-bonded chopped-strand mat glass fiber and resin systems were compared for the three various resin types. Especially, the flexural strength, tensile strength and modulus were compared through compressed plate in hot mold. The ballistic test result showed that the HMC shields have ballistic resistance against 9 mm fragment simulating projectiles (FSP) up to 435 m/s projectile velocities. The extensions of damages in the composites were evaluated after impact. It was concluded that the HMC shields that made with unsaturated polyester and vinyl ester have capacity against the ballistic threats and potential to be used as shield materials level IIIA.

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Natural polymer, zein, for tissue regeneration

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Zein is the major storage protein of corn and comprises 40-50% of total endosperm proteins. Zein has been used as microspheres to delay the release of drugs and to protect the drugs from degradation by pepsin, thus can release the drugs for a long time. Our laboratory has developed zein as a novel and potential biomaterial for tissue engineering. Firstly, a three-dimensional zein porous scaffold was prepared and showed to be suitable for culture of various cell lines and primary cells such as human umbilical vein endothelial cells (HUVECs) and mesenchymal stem cells (MSCs) *in vitro*. The scaffolds are characterized with interconnected pore, controllable pore sizes, especially excellent mechanical properties, which are controllable and suitable to act as bone substitutes. Next, we examined its tissue compatibility in a rabbit subcutaneous implanting model, the histological analysis revealed a good tissue response and degradability. The third, zein porous scaffolds modified with fatty acids have shown great improvement in mechanical properties and also good cell compatibility *in vitro*. Besides, the complex of zein porous scaffold and mesenchymal stem cells (MSCs) could effectively promote the ectopic bone formation in nude mice and the repair of critical-sized bone defects in the rabbit model.

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