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Experimental investigation of thermal conductivity and tensile strength of iron ore tailings filled polypropylene composite

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Iron ore tailings (IOT) filled polypropylene (PP) composites were produced by reinforcing polypropylene with iron ore tailings which is a waste product. Particle sizes 53 μm, 75 μm and 100 μm were considered for different volume fractions of 0% to 40% at intervals of 5%. The thermal conductivity of the IOT filled PP composites was determined using the transient techniques employed in the KD2 pro thermal analyzer. 30% volume of iron ore tailings gives increase in thermal conductivity of the composite. Tensile test was conducted and the experimental results were compared with theoretical results obtained from suitable mathematical models. It was discovered that the smaller the particle sizes of the iron ore tailings, the higher the thermal conductivity and tensile strength. The thermal conductivity increases as the volume fraction increase for either particle size. However, the thermal conductivity and tensile strength start to fall from 35% to 40% because the polymer starts to loss its stability at these volume fractions.

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Machinable hydroxyapatite: Yttrium phosphate bio-ceramic composite drilling quantification and bioactivity

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The use of Hydroxy-apatite bio-ceramics as restorative implants is widely known. These materials can be manufactured by pressing and sintering route to a particular shape. However machining processes are still a basic requirement to give a near net shape to those implants for ensuring dimensional and geometrical accuracy. In this context, optimizing the machining parameters is an important factor to understand the machinability of the materials and to reduce the production cost. In the present study a method has been optimized to produce true particulate drilled composite of Hydroxyapatite Yttrium Phosphate. The phosphates are used in varying ratio for a comparative study on the effect of flexural strength, hardness, machining (drilling) parameters and bioactivity. The maximum flexural strength and hardness of the composite that could be attained are 46.07 MPa and 1.02 GPa respectively. Drilling is done with a conventional radial drilling machine aided with dynamometer with high speed steel (HSS) and solid carbide (SC) drills. The effect of variation in drilling parameters (cutting speed and feed), cutting tool, batch composition on torque, thrust force and tool wear are studied. It is observed that the thrust force and torque varies greatly with the increase in the speed, feed and yttrium phosphate content in the composite. Significant differences in the thrust and torque are noticed due to the change of the drills as well. Bioactivity study is done in simulated body fluid (SBF) up-to 28 days. The growth of the bone like apatite has become denser with the increase in the number of days for all the composition of the composites and it is comparable to that of the pure hydroxy-apatite.

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