

A
Project Report
On
“High Performance Polymeric Nanocomposites for Biomedical Application”

Submitted in partial fulfillment of the requirement of the degree of

Master of Technology

(Materials Engineering)

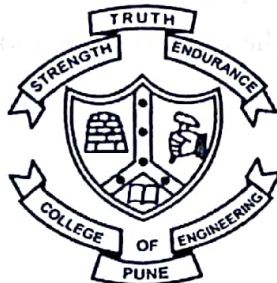
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Abstract

Polyaryletherketone (PEK) is a high temperature semi-crystalline thermoplastics polymer which has high glass transition and melting point of 157 °C and 370 °C, respectively. In present work, planetary ball milling was used for mixing PEK and nano hydroxyapatite (HA) powder. PEK-HA nanocomposites were fabricated successfully using hot compaction at 15 MPa pressure and 360 °C temperature for 20 mins of dwell period. Density of the nanocomposites was found close to the theoretical density. Dispersion of hydroxyapatite nanoparticles was successfully observed by SEM technique and TEM image of HA has revealed its range from 20 to 80 nm. XRD analysis of nanocomposites have shown phase present Thermal properties of the nanocomposites will be checked by TGA and DSC. It is expected that decomposition temperature increases with increase in HA nanoparticles. DSC will increase glass transition temperature on HA nanoparticles addition. Crystallization temperature decreases in cooling cycle of DSC with increase in HA nanoparticles. Microhardness of the composites increased moderately with increasing hydroxyapatite nanoparticles. Further Dynamic mechanical analyser (DMA) will be used to find storage modulus, loss modulus and tan delta. Storage modulus of nanocomposites is increased by 35 % from 4353 MPa to 6666 MPa for 30 wt. % of HA nanoparticles. Loss modulus is also increasing slightly with increase in HA nanoparticles. Bioactivity of the nanocomposite will be checked by immersing nanocomposites in SBF (Stimulated Body Fluid) for different period of time. It is expected that the thickness of apatite layer increases with increase in nano hydroxyapatite loading in the composite. This nanocomposite is generally used in biomedical implants such as Total Hip Replacement and Total Knee Arthroplasty.