

Development of new generation Acetabular Socket Liner and Femoral Head Prototypes with unique 3D microstructures and better fracture resistance for Osteoporosis and Osteoarthritis – Funding - SERB(IMPRINT)

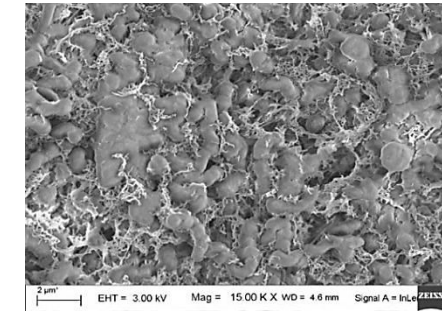


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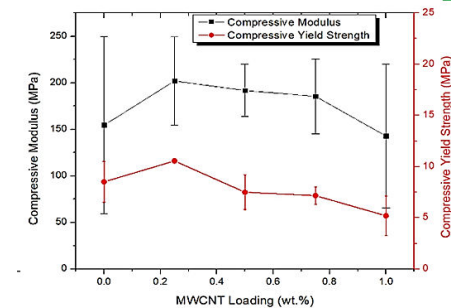
Objective: • To manufacture HA-UHMWPE-CNT-based novel bilayer acetabular socket liner with UHMWPE-MWCNT on bearing side and UHMWPE-HA on pelvis side for uncemented hip prosthesis, • To conduct performance-limiting testing on both femoral head and acetabular socket prototypes

Highlights and achievements :

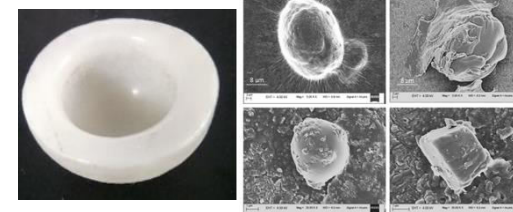
- A novel technique for dispersion and distribution of MWCNT in UHMWPE powder was successfully applied
- The highest mechanical properties of composites was achieved at 0.25 wt.% of MWCNT with 77 % increase in hardness, 43% improvement in compressive strength and 33.33 % increment in compressive modulus over virgin polymer
- A novel manufacturing technique is developed which can produce any size of Acetabular cup specific to the patient using UHMWPE or UHMWPE/MWCNT powder having Plateau finished bearing surface with $R_a < 0.1 \mu\text{m}$ without any machining process
- A mixture of 2% w/v high molecular weight sodium alginate and 0.75% w/v gellan gum in 1:2 volumetric ratio was found to be rheologically similar to the synovial fluid and it is used as a lubricant in tribological characterization of the developed materials.
- A mechanism as per ISO-14242-3 is designed for the existing pin-on-disc device to modify the same into a ball-on-cup tribometer to elucidate the wear mechanism experienced by a THA during its usage and predict its clinical life
- The *in vitro* wear tests of acetabular cups with composite against stainless steel femoral head are tested, where the same tribological behaviour of retrieved implants was observed.



Dispersion and distribution of MWCNT in UHMWPE



Enhancement of mechanical properties of UHMWPE after reinforcement



UHMWPE Acetabular cup and the wear debris generated from it after 5 million cycle of simulator test against stainless steel femoral head



UHMWPE/MWCNT Acetabular cup and the wear debris generated from it after 5 million cycle of simulator test against stainless steel femoral head



The assembled OBM simulator after fabrication