J Material Sci Eng 2017, 6:4(Suppl)
DOI: 10.4172/2169-0022-C1-071

Developing of a 3D printing method to fabricate a bone replacement hydroxyapatite/polycaprolactone scaffolds

Sara Ahmadi and **Saeed Saber Samandari**
Amirkabir University of Technology, Iran

Recently, usage of 3D printing methods to fabricate all type of human organ has been considered. Among all of them, 3D printed scaffolds to be utilized as bone replacement implant have been investigated comprehensively. The advantage of this method is fabricating an implant with exact dimensions of the actual bone tissue. In addition, this method is faster than the conventional methods which surgeon used to apply to replace the injured or infected bone tissue. First of all, polycaprolactone with different concentrations of hydroxyapatite (0, 10%, 15% and 20%) were mixed completely. The HA/PCL composite was prepared with 40%, 50%, and 60% porosity. Then by using a spinneret, we transfer the HA/PCL composite to filament with a specific diameter (1.65-1.85 mm). We used these filaments to feed the 3D printer instrument. As a model, a femur bone of rabbit was used to design the scaffolds. The femur bone of rabbit was 3D scanned and transferred to Simplify 3D software to prepare the 3D printing pattern. The open source 3D printer printed the HA/PCL filament exactly similar to the rabbit bone. The mechanical properties of the 3D printed scaffold was determined and compared to femur rabbit bone. In terms of 3D printed scaffold characterization, the yield strength, stress-strain, force, stiffness, compressive modulus, and surface morphology of them have been studied.

s.ahmadi96@aut.ac.ir

Critical role of *in-situ* formed wide-graphene nanoribbons (Wide-GNRs) on the mechanical and thermal shock behaviors of spark plasma sintered titanium carbide composites

Sribalaji M[1], **Biswajyoti Mukherjee**[1], **Srinivasa Rao Bakshi**[2] and **Anup Kumar Keshri**[1]
[1]Indian Institute of Technology, Patna, India
[2]Indian Institute of Technology, Madras, India

Carbon nanotubes/CNTs (2 wt.%) reinforced titanium carbide (TiC) ultra high temperature ceramic with 3.5 wt.% of tungsten carbide (WC) as sintering aid was fabricated using spark plasma sintering (SPS) technique at 1600°C and 50 MPa pressure. *In-situ* formation of wide graphene nanoribbons (wide-GNR) was observed after sintering. High resolution transmission electron microscopy (HR-TEM) and Raman spectroscopy techniques confirmed the presence of *in-situ* formed wide-GNRs. Mechanical properties of TiC, TiC-WC and TiC-WC-CNT sintered pellets were evaluated using an instrumented microindenter at a load of 49 N. No significant change was observed in the hardness of TiC after the reinforcement of WC and CNT. However, the reinforcement of CNT and *in-situ* formation of GNR in TiC-WC-CNT pellet has showed a drastic improvement of ~126% and ~ 98% when compared to TiC and TiC-WC sintered pellets respectively. This significant enhancement in the fracture toughness of TiC-WC-CNT pellet can be attributed to the novel toughening mechanisms like GNR pull out, GNR grain wrapping, GNR crack bridging, crack bifurcation, CNT pull out and CNT grain gluing. Further, the thermal shock behaviour of TiC, TiC-WC and TiC-WC-CNT sintered pellets was determined at 1700°C using conventional water quenching test. The results from the thermal shock analysis showed that TiC-WC-CNT pellet has higher resistance to thermal shocks compared to other TiC composites. The microstructural investigations after thermal shock test indicate that higher thermal resistance is strongly dependent on the reduced formation of oxide phases.

Sribalaji.pms13@iitp.ac.in