

Multifunctional characteristics of 3D printed polymer nanocomposites under monotonic and cyclic compression

Pawan Verma¹, Jabir Ubaid¹, Fahad Alam¹, Suleyman Deveci², S Kumar^{3*}

¹Department of Mechanical Engineering, Khalifa University of Science and Technology, Masdar Institute, Masdar City, P.O. Box 54224, Abu Dhabi, United Arab Emirates

²Borouge Pte. Ltd., Innovation Centre, Sas Al Nakhl, 6951 Abu Dhabi, United Arab Emirates

³James Watt School of Engineering, University of Glasgow, Glasgow, G12 8QQ, UK

Supporting information

S1. Raman Spectroscopy of PPR/MWCNT composites

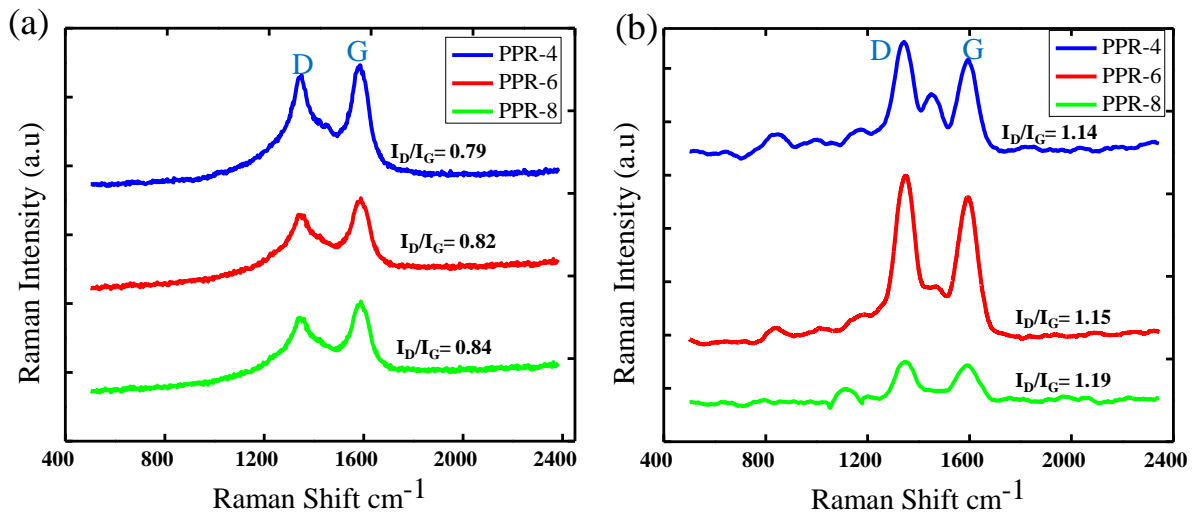


Fig. S1. Raman spectra of PPR/MWCNT composites samples (a) before compression test and (b) after compression test.

To evaluate the structure of PPR/MWCNT nanocomposites, Witech Alpha 300RAS Raman spectrometer (wavelength 532 nm) was used. 3D printed samples were used for Raman studies, and spectra were recorded with Raman shift between 100 to 3500 cm^{-1} . Figure S1 (a) and (b)

displayed Raman spectra of PPR/MWCNT composites samples before compression and after compression test respectively. Spectra of PPR/MWCNT composites clearly reveals the change in the MWCNTs networks after compression test. The I_D/I_G ratio is higher in compress samples for all the composition levels the more disorder structure. This observation can be used as the indication of formation of more MWCNTs networks during compression test [1].

Table S1. Process parameters for the extrusion of PPR and PPR/MWCNT filament feedstock.

Process Parameters	Values				
Extruder zone	1 st	3 rd	5 th	7 th	9 th
Temperature Profile (°C)	180	190	200	210	220
Die temperature (°C)	220				
Speed (rpm)	200				

Table S2. Process parameters for fused filament fabrication of PPR and PPR/MWCNT composites.

Process Parameter	Values
Nozzle tip temperature	230 °C
Bed temperature	120 °C
Infill density	100%
Extrusion width	0.4 mm
Nozzle movement speed	900 mm/min
Layer height	0.1 mm
Extrusion width	0.48 mm

Reference

[1] P. Verma, P. Saini, R.S. Malik, V. Choudhary, Carbon, 89 (2015) 308-317.