EuroSciCon

Euroscicon Conference on

3D Printing and Wireless Technology

September 17-18, 2018
Lisbon, Portugal

Am J Compt Sci Inform Technol 2018 Volume: 6
DOI: 10.21767/2349-3917-C2-006

DEVELOPMENT OF A SCREW EXTRUSION-BASED 3D PRINTER AND ITS BIOMEDICAL/MICROFLUIDIC APPLICATIONS

An Bang Wang[1, 2], Hung Nien Chiu[1], Ming Che Hsieh[1], Jian Wei Tseng[1], Pei Hsun Tsai[1] and Chih Lung Chin[3]

[1]Institute of Applied Mechanics, National Taiwan University
[2]Institute of Medical Device and Imaging, National Taiwan University, Taiwan
[3]Material and Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan

The printing technology of fused deposition modeling (FDM) is the most widely used additive manufacturing method among all commercial 3D printers. Despite its fast spreading and various development in recent years, there are still some limitations, e.g., restricted materials for printing, instability caused back flow or nozzle clogging issues and lower mechanical strength of printed products etc. A brief review and our strategy will be introduced at the beginning of this presentation. To broaden the printing material selectivity for thermal plastic materials of highly viscous materials (generally with higher melting temperatures), a new 3D printer for Polyether ether ketone (PEEK) has been developed and tested, where PEEK is widely used in biomedical and chemical engineering applications due to its high mechanical strength, thermal performance, and biocompatibility. The screw extrusion method was adapted and developed to overcome those existing problems of the filament-feeding method and excellent flow stability and high printing speed were achieved for PEEK printing. Its guideline to build a 3D printer for highly viscous materials will be presented. Furthermore, a new design of exchangeable printing head was built to cover both line- and plane-printing needs to widen its applications and improve printing surface quality. Highly reproducible mechanical tests of the printing products under well-controlled environment were demonstrated and a record of 96% bulk material strength has been achieved for the first time. Besides, the post annealing process was found to have no significant effect on the mechanical strength and all printed material had a more brittle character in comparison with the bulk material. At the end, different printing products, including porous artificial intervertebral cages with controllable size and distribution for biomedical use and various microfluidic structures of micro-reactor for chemical engineering designs etc., were manufactured to demonstrate its great potential applications.

abwang@spring.iam.ntu.edu.tw