World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:16, No:02, 2022

Development of a Table-Top Composite Wire Fabrication System for Additive Manufacturing

Authors : Krishna Nand, Mohammad Taufik

Abstract : Fused Filament Fabrication (FFF) is one of the most popular additive manufacturing (AM) technology. In FFF technology, a wire form material (filament) is fed inside a heated chamber, where it gets converted into semi-solid form and extruded out of a nozzle to be deposited on the build platform to fabricate the part. FFF technology is expanding and covering the market at a very rapid rate, so the need of raw materials for 3D printing is also increasing. The cost of 3D printing is directly affected by filament cost. To make 3D printing more economic, a compact and portable filament/wire extrusion system is needed. Wire extrusion systems to extrude ordinary wire/filament made of a single material are available in the market. However, extrusion system to make a composite wire/filament are not available. Hence, in this study, initial efforts have been made to develop a table-top composite wire extruder. The developed system is consisted of mechanical parts, electronics parts, and a control system. A multiple channel hopper, extrusion screw, melting chamber and nozzle, cooling zone, and spool winder are some mechanical parts. While motors, heater, temperature sensor, cooling fans are some electronics parts, which are used to develop this system. A control board has been used to control the various process parameters like – temperature and speed of motors. For the production of composite wire/filament, two different materials could be fed through two channels of hopper, which will be mixed and carried to the heated zone by extrusion screw. The extrusion screw is rotated by a motor, and the speed of this motor will be controlled by the controller as per the requirement of material extrusion rate. In the heated zone, the material will melt with the help of a heating element and extruded out of the nozzle in the form of wire. The developed system occupies less floor space due to the vertical orientation of its heating chamber. It is capable to extrude ordinary filament as well as composite filament, which are compatible with 3D printers available in the market. Further, the developed system could be employed in the research and development of materials, processing, and characterization for 3D printer. The developed system presented in this study could be a better choice for hobbyists and researchers dealing with the fused filament fabrication process to reduce the 3D printing cost significantly by recycling the waste material into 3D printer feed material. Further, it could also be explored as a better alternative for filament production at the commercial level.

Keywords : additive manufacturing, 3D Printing, filament extrusion, pellet extrusion
Conference Title : ICAMPT 2022 : International Conference on Advances in Materials and Processing Technologies
Conference Location : Jeddah, Saudi Arabia
Conference Dates : February 17-18, 2022