

Oral (S12-242, Time: Wednesday 11:00, Room: Angst+Pfister)

3D printing fused filament fabrication (FFF) with recycled PP

Battegazzore Daniele¹, Bernagozzi Giulia¹, Cravero Fulvia¹, Arrigo Rossella², Frache Alberto²

¹Politecnico di Torino, Torino, Italy

²Politecnico di Torino, Alessandria, Italy

The Circular Economy Package in 2015 set for Europe specific key targets including recycling of municipal wastes at the level of 65% until 2030, recycling of packaging waste at the level of 75% until 2030, and reduction of landfilling to a maximum of 10% until 2030. In 2020 only 32% of polymers were collected for recycling, while 25% were sent to landfill and 43% were incinerated. The plastic recycling has therefore become one of the main challenges of environmental protection and waste valorization as it is recognized as an effective method to reduce the use of new natural resources through the recovery of materials. The use of waste or recycled thermoplastics for the development of 3D-printed parts is an emerging sector. Several case studies will be presented including the recycling of surgical masks and the recycling of industrial mixed polyolefin to demonstrate the possibility of exploiting recycled PP for the formulation of filaments that are suitable for FFF 3D printing processes. A Taguchi design of an experimental method was also used to optimize the processing conditions of blends showing adequate rheological and thermal characteristics for FFF. Blends containing till 50 wt.% of r-PP were selected for the production of filaments and for the subsequent 3D printing through FFF. The morphological observations allowed for verifying the quality of the produced samples, confirming the effectiveness of the proposed method in achieving FFF-printable materials. Finally, the mechanical characterization of the printed samples showed that adequate tensile properties were achieved compared to samples printed using commercial filaments. Overall, the obtained results demonstrated the possibility of using recycled polymers for additive manufacturing processes, therefore, allowing the valorization of a waste material through its exploitation for an advanced and sustainable manufacturing approach.