3D printed polymers to tailor thermal and electrical properties

M. Raimondo[1,*], F. Aliberti[1], E. Calabrese[1], T.R. Verde[2], L. Guadagno[1]
[1]University of Salerno, Department of Industrial Engineering, via Giovanni Paolo II 132 – 84084 Fisciano, Italy,
mraimondo@unisa.it, faliberti@unisa.it, elicalabrese@unisa.it, lguadagno@unisa.it
[2]Arpac Dipartimento di Napoli, Area Territoriale, via Don Bosco 4/F – 80141 Napoli, Italy,
teresarosariaverde@libero.it

Keywords. 3D printing composites, electrical properties, joule effect, self-heating element, electrical properties

Abstract.
FDM (Fused Deposition Modeling) 3D-printed parts, based on acrylonitrile butadiene styrene (ABS) with multi-walled carbon nanotubes (MWCNTs), are manufactured to obtain different multi-scale configurations of the internal conductive pathways. By appropriately selecting materials and printing parameters, it is possible to control the alignment of MWCNTs and related conductive network arrangement through the sample. This approach, together with a suitable choice of the electrical contact position, allows controlling the flow of the electrical current, conferring parts the ability to heat up when subjected to an electrical source selectively. This energy-saving strategy can be advantageously applied to print quickly, in a single step, electronic devices, thermistors capable of converting electrical energy into thermal energy, heat exchangers, and electromagnetic interference (EMI) and radio frequency interference (RFI) shielding.