Fracture surface analysis of ABS samples printed by the FDM method

Raquel de Moraes Lobo[1], Aparecido Edilson Morcelli[2], Francisco José Breda[1], Mariano Castagnet[1], Arnaldo Homobono Paes de Andrade[3]

[1]Instituto de Pesquisas Energeticas e Nucleares, [2]Instituto de Criminalística da Polícia Científica de São Paulo, [3]Instituto de Pesquisas Energeticas e Nucleares (*Centro de Ciência e Tecnologia dos Materiais*)

e-mail: rmlobo@ipen.br

FDM (Fused Deposition Modeling) is one of the most used technique in additive manufacturing (AM). It can be summarized as printing small components through a heated thermoplastic filament, which is deposited layer by layer through a 3D printer. The print head can be programmed to perform the job in different directions (X, Y and Z) even with predetermined slopes.
In this work, flat tensile specimens were prepared in different directions using an ABS (Acrylonitrile-Butadiene-Styrene) filament with a processing temperature between 210-225 ° C. After tensile tests, the fracture surfaces were analyzed to get a better understanding of the deformation and fracture processes. The cross-section view of specimen´s morphology was examined with a scanning electron microscope at a very low accelerating voltage (1 kV). The specimens were coated with gold using a sputtering system.

The specimens that showed the smaller ultimate strength (named V-specimen) presented numerous large cavities in its microstructure suggesting that these voids may have a major contribution to the mechanical performance of the material.The fracture surface also shows a possible pull-out between layers indicating a weak point in the microstructure of the built sample that’s requires further investigation.