IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Advancements in Materials Applications and Rapid Prototyping (5)

Author: Mrs. Lucia Pigliaru
ESA - European Space Agency, The Netherlands, lucia.pigliaru@esa.int

Dr. Marianna Rinaldi
University of Rome - Tor Vergata, Italy, marianna.rinaldi@uniroma2.it
Dr. Leonardo Ciccacci
University of Rome - Tor Vergata, Italy, leonardo.ciccacci@gmail.com
Mr. Lorenzo Paleari
University of Rome - Tor Vergata, Italy, lorenzo.paleari@gmail.com
Dr. Mario Bragaglia
University of Rome - Tor Vergata, Italy, bragaglia@ing.uniroma2.it
Dr. Andrew Norman
ESA, The Netherlands, Andrew.Norman@esa.int
Dr. Thomas Rohr
European Space Agency (ESA), The Netherlands, Thomas.Rohr@esa.int
Dr. Tommaso Ghidini
ESA - European Space Agency, The Netherlands, tommaso.ghidini@esa.int
Prof.Dr. Francesca Nanni
University of Rome "Tor Vergata", Italy, fnanni@ing.uniroma2.it

PEEK/NDFEB 3D PRINTED MAGNETIC MATERIALS

Abstract

Permanent Rare Earth magnets are becoming more and more important in efficient motors and generator for space applications. In particular, they can be found in pointing and scanning mechanisms, deployment systems for solar arrays or antennae (along with pyrotechnical solutions), hold-down, release and separation systems. They are also crucial in handling mechanisms like robotic arms, grippers and articulated joints, among others. One of the most diffused composition for space application is Neodymium Iron Boron (NdFeB). These magnets are characterized by high remanence, higher coercivity and energy product, but due to their poor corrosion resistance, they could be susceptible to degradation of magnetic properties. One of the possible solution to solve this issue has been considered in the development of innovative 3D printed composite magnetic material based on Polyether ether ketone (PEEK) and NdFeB particles characterized by enhanced corrosion resistance and space environment compatibility. The demonstration of the feasibility of this process was the main scope of the activity presented in this abstract. Peek matrix and NdFeB fillers were characterized prior to use in terms of microstructure (scanning electron microscope) and phase analysis (X-rays diffraction). As part of the research activity, PEEK-NdFeB composite have been extruded in feedstock filaments for fused deposition modeling (FDM) printing technique using different percentages of filler as well as PEEK neat as reference. In the frame of the research activity the influence of the filler and its effect on the 3D printing process were evaluated by means of different investigation techniques. Furthermore, the behavior of the composite material when exposed to corrosive environment was also assessed as part of the study confirming the beneficial presence of PEEK in protecting NdFeB particles against corrosion. The magnetic properties exhibited by FDM printed parts were also measured and confirmed the feasibility of the magnetic 3D printed composite with

PEEK and its enhanced corrosion protection behavior.