

**“MATERIALI NANOCOMPOSITI MULTIFUNZIONALI A MATRICE POLIMERICA  
PER L’ADDITIVE LAYER MANUFACTURING”**

**Prof. Ing. Francesca Nanni**

University of Rome “Tor Vergata” – Department of Enterprise  
Engineering – Via del Politecnico 1, 00133 Rome .

[fnanni@ing.uniroma2.it](mailto:fnanni@ing.uniroma2.it)

**Ing. Marianna Rinaldi, PhD**

**Ing. Mario Bragaglia, PhD**

**Ing. Fabio Franceschetti**

**Ing. Lucia Pigliaru, PhD Student**



# The context of Industry 4.0

✓ Industry 4.0 is mainly focused on

*Introduction of Digital Technology (IoT, Big Data, Artificial Intelligence, Cloud, advanced Automation, ecc.)  
within plants, processes and management*

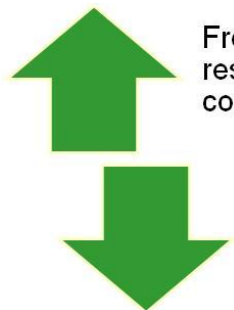
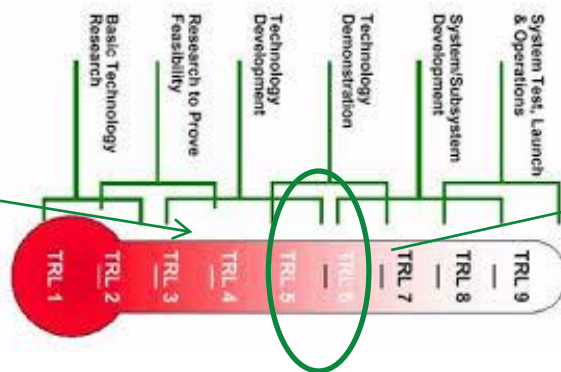
It is a complex process that involves different fields, expertise, competences, infrastructures: it has to be handled with care.

✓ MANUFACTURING 4.0 is a part of this process and of the **Value Chain (EU)**

where Science, Technology and Market  
work synergically to increase productivity  
and quality of life in a view of  
Sustainable economy, environment,  
society



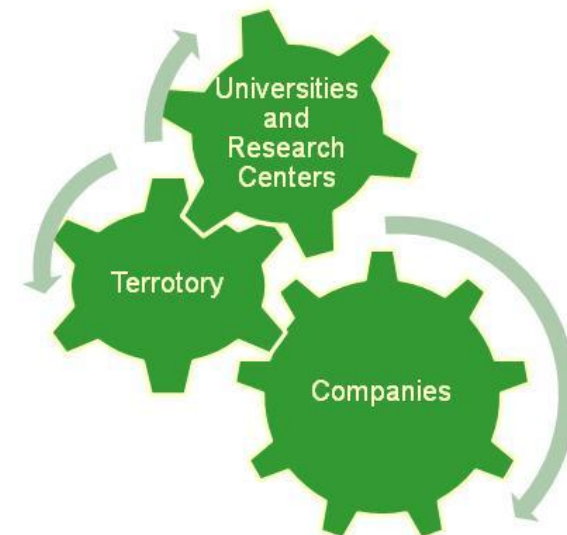
# The mission: New Materials & Technology Transfer



From basic  
research towards  
companies needs

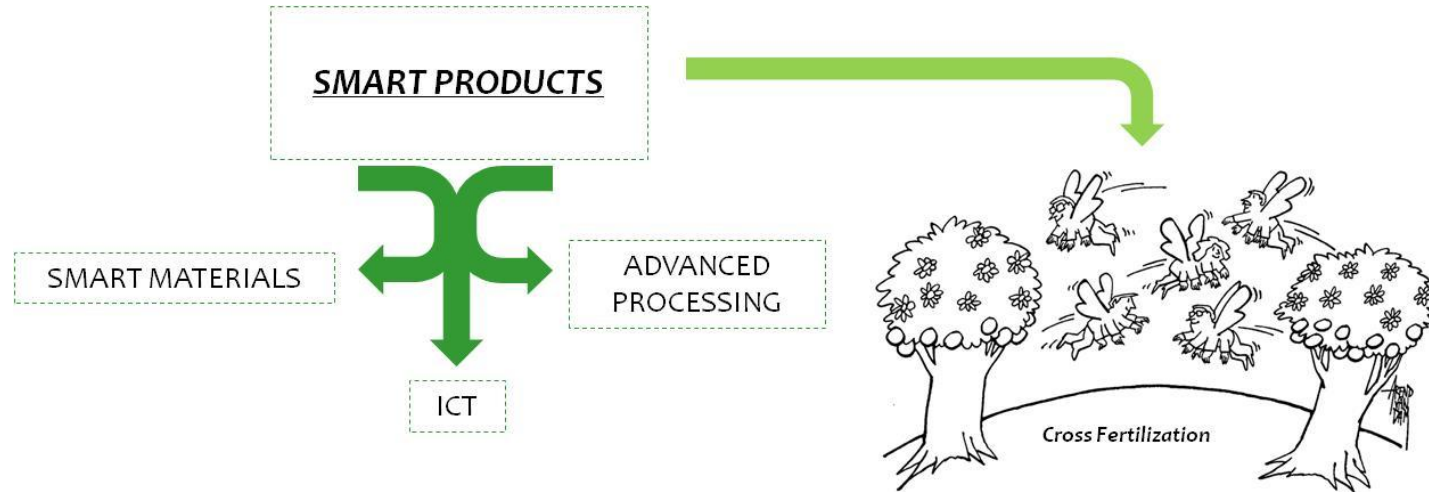
From an industrial  
need/idea towards  
research

The Materials Science and  
Technology group is active towards  
the development and Technology  
Transfer Process of innovative  
materials, working with large and  
SME companies



## SMART PRODUCTS

Those that can integrate multiple functions, provide new or powered functions, typically interacting with the external environment, ecc.



## SMART MATERIALS

Either passive (need of external stimuli) or active (no need of external stimuli) are materials that provide multiple functions beyond the structural one.

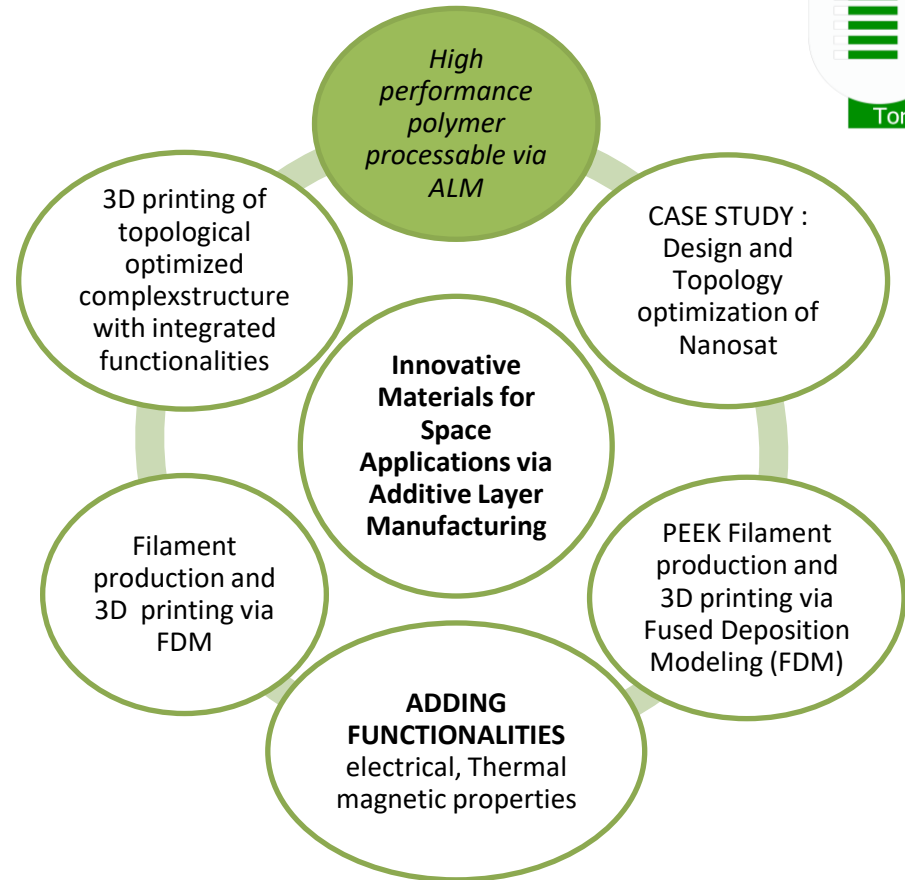
# The Project: multifunctional polymer composite for ALM

## **Additive Layer Manufacturing**

Provides the opportunity of manufacturing new engineering designs, not achievable with traditional processes.



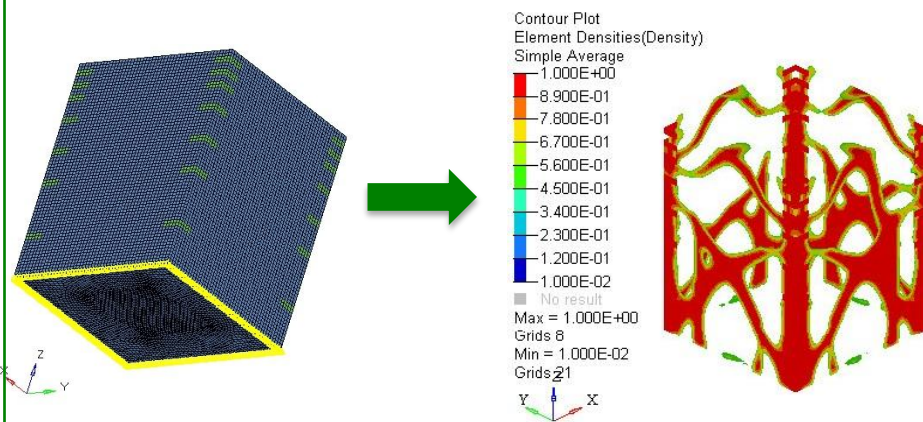
Lighter structures



M. Rinaldi, et al. Journal of Composites B 145 (2018) 162-172

# The Project: multifunctional polymer composite for ALM

*ALM POLYMERIC CUBESAT Topological Optimization leading to new design with same mechanical performance with less weight*



Contour Plot  
Element Densities(Density)  
Simple Average

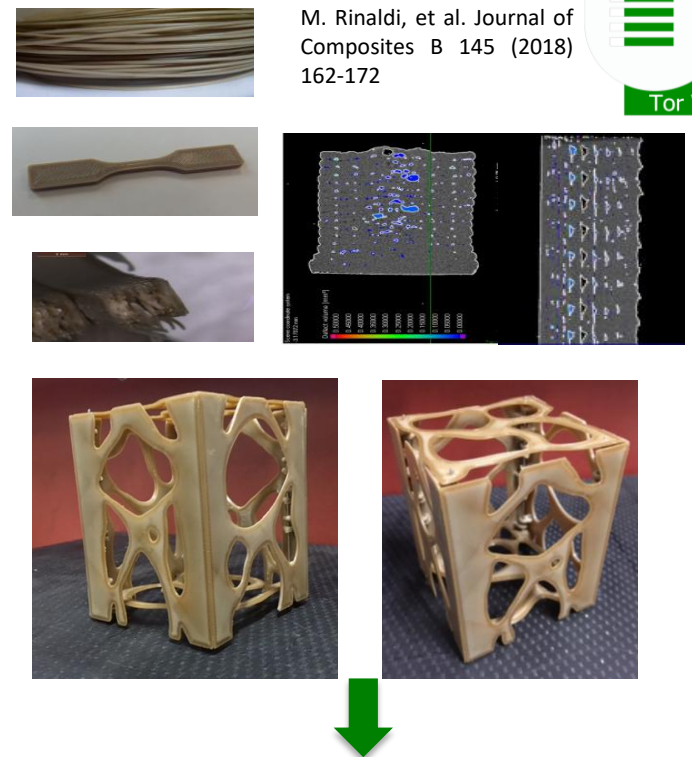
1.000E+00
8.900E-01
7.800E-01
6.700E-01
5.600E-01
4.500E-01
3.400E-01
2.300E-01
1.200E-01
1.000E-02
No result

Max = 1.000E+00  
Grids 8  
Min = 1.000E-02  
Grids 21

ESA -NPI Programme Contract . 4000112506 The European Space Agency  
ESA/ESTEC, Noordwijk, The Netherlands, endorsed by Thales Alenia Space Italy,  
Mecaer Aviation Group

L.Pigliaru, et al *New High performance thermoplastic composite with added functionalities for 3d printed structure for space applications* European Conference on ECSSMET - Noordwijk NE - 28 May - 1 June 2018

L.Pigliaru et al- Long Term Storage Issues of NdFeB magnets: coatings and PEEK/ NdFeB composites as alternative approaches AC-18-F1.2.3 69th International Astronautical Congress (IAC), Bremen, D, 1-5 Oct 2018



**Adding thermal and magnetic functionalities**

Progetto SCAMP "Regione Lazio POR FESR Lazio 2014-2020, Bando Kets Tecnologie Abilitanti

