

**Dottorato di Ricerca in Fisica dell'Università degli Studi di Messina**  
**24 Luglio 2018, ore 15.00**  
**Incubatore di Impresa, Aula HT3-1,**  
**Dip.to MIFT, V.le F. Stagno d'Alcontres 31, S. Agata (ME)**

## **Ion Beam Analysis applied in material science and cultural heritage**

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### **Abstract:**

An overview of the research activity related to Ion Beam Analysis methods performed at Tandetron Laboratory (LT) of the Nuclear Physics Institute in the Czech Republic will be presented.

The unique ion micro beam system present in the Czech Republic belongs to our laboratory and it is used for the production of three- dimensional (3D) micro-structures in polymeric resists and in graphene based materials. Several micro- scale structures and circuits have been fabricated selecting the beam, the energy, the fluence, the exposition time. The quality of the side walls of the produced structure was investigated by Scanning Transmission Ion Microscopy (STIM). The characterizations of the fabricated microtunnels will be presented and discussed.

Following up the increasing demand of advanced material engineering in microelectronics, biomedicine, laser matter interaction, several type of new generation of hybrid material are designed and produced. A systematic study of compositional, structural, optical properties of polymers, ceramics, graphene based material correlated to their response consequence of ion, electron, laser mechanical chemical treatments, is essential for understanding as various topological defects and chemical functionalization can modify the properties of the initial material system and for reliability and reproducibility of the systems.

Another interesting field we are developing in collaboration with the University of Messina is related to the cultural heritage field. Non-destructive and non-invasive multi-analytical approach was employed to perform self-consistent analyses taking advantage of their complementary character in the study of inestimably high value painted surface of plasters, mosaics, coins belonging to renowned archaeological sites in Italy, Greece and Egypt. To identify the composition, pigments, the materials used for the decorations, the manufacturing procedure and to study the preservation of the objects, X-ray fluorescence, Rutherford Backscattering Spectroscopy (RBS), Particle Induced X-ray Emission (PIXE) implemented with an external micro ion beam, neutron activation analysis and Prompt  $\gamma$  activation analysis were employed in a straightforward and powerful way treating all these techniques as a part of one single coherent analysis. The benefits of these combinations of techniques will be illustrated.