

## Determination of elemental composition for matrix nanocomposites polymers/metal nanoparticles, InN and nanostructured carbon materials using PIXE

### Applications

a) Research on polymeric nanofibers known important progress lately. Thus, polymeric nanofibers are highly used in biomedical and biotechnological applications. These include medical implants, dental applications, biosensors, conservation of biological agents which are used for wound's patches, etc.

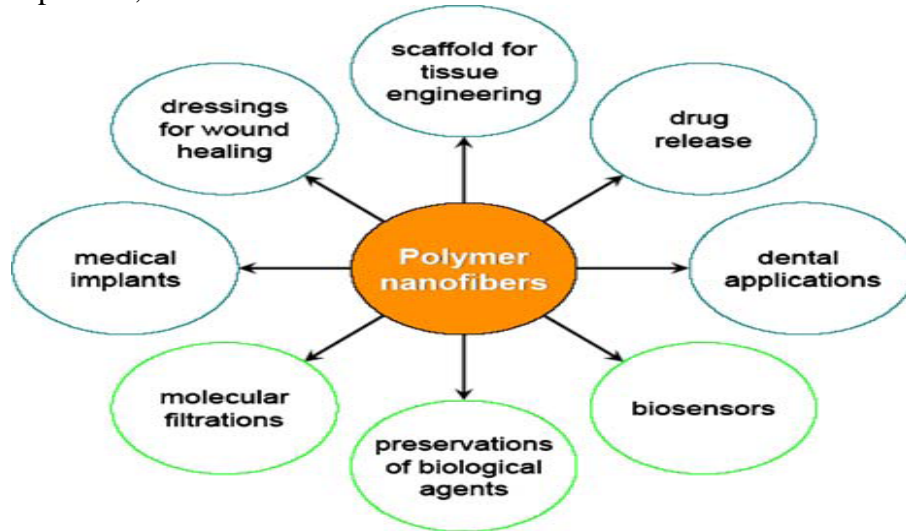


Figure 1). Biomedical and biotechnological applications of polymeric nanofibers

Silver nanoparticles have effective antimicrobial properties compared with other salts due to the extremely large surface to produce a better contact with micro-organisms. Silver is known as one of noble metals with the highest biocompatibility. Nanoparticles is tied to cell membranes and also penetrate inside the bacteria.

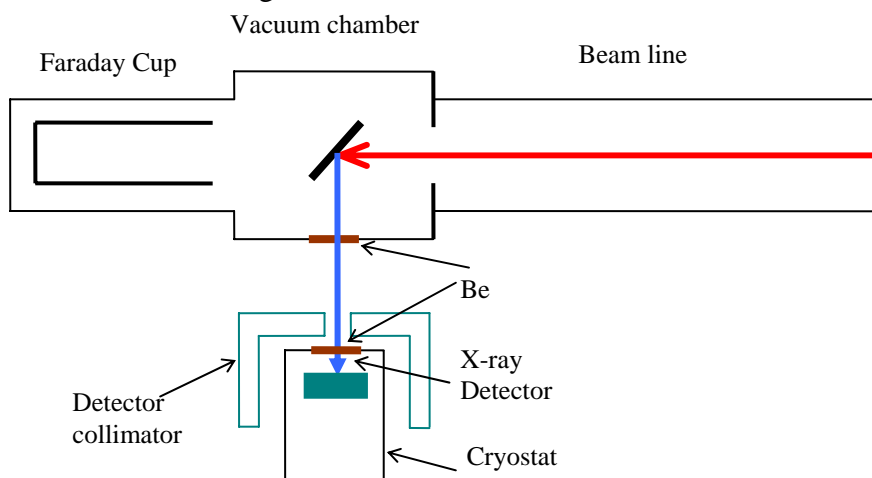
b) Until now the particular electronic state and transport effects were studied in semi-metallic and metallic structures, for which all lengths are typical sizes isotropic. In semiconductors (semiconductors with narrow forbidden band type AIV-BVI, Si, Ge n-type or Inn, ZnO) are typical lengths anisotropic. Study type **quantum dots** structures (QD) from such materials offer the possibility to study effects related to optical emission in low dimensionality structures. A **quantum dot** is a semiconductor whose excitons are confined in all three spatial dimensions. As a result, they have properties that are between those of bulk semiconductors and those of discrete molecules. Quantum dots are particularly significant for optical applications due to their theoretically high quantum yield. In electronic applications they have been proven to operate like a single-electron transistor and show the Coulomb blockade effect. Quantum dots have also been suggested as implementations of qubits for quantum information processing. The ability to tune the size of quantum dots is advantageous for many applications. For instance, larger quantum dots have a greater spectrum-shift towards red compared to smaller dots, and exhibit less pronounced quantum properties. Conversely, the smaller particles allow one to take advantage of more subtle quantum effects.

c) Applicative potential of carbon nanowall (CNW) is correlated with structure, the dimensional asymmetry (thickness reported in area), sharp edges and the extended surface in relation to the volume occupied. In agreement with these properties, research on the applicability with focus on field emission, electrical resistivity anisotropy, gas storage capacity and catalytic nanoparticles. Possible applications are electronic devices, new display devices and light sources with low consumption, membranes for fuel cells, catalysts for chemistry or un-pollution support.

### Elemental analysis

The impurities in certain materials has a great importance in terms of their properties, improving or often resulting in loss of desired properties for the material in question. Thus more precise knowledge of their presence in samples to be analyzed has a great importance.

At this stage we intend to carry out elemental analysis using PIXE. Experimental setup to be used is sketched in Figura3.



*Figure 3 The scheme used for PIXE measurements*

We estimate for each sample a acquisition time of about 2 hours, taking in consideration that we don't have a multi-target PIXE chamber at least 20 minutes are wasted for each sample. We have to analyze 30 samples which goes to a total time of about 3 days. In order to fulfil our experiment we intend to use extension 5 of the TANDEM accelerator in collaboration with dr. C. Ciortea. Beam characteristic: 3 MeV, protons, 10 nA.

Resulting data will be reported in the third stage of a National Partnership Grant. (PNCDI2 72-191, acronym NUCNANO) where IFIN-HH is the project coordinator. Deadline for the 3rd stage of NUCNANO project is November 27, 2010.

The results will be also presented in a conference which will take place in February 2011. This conference is hosted in a COST action „Composites of Inorganic Nanotubes and Polymers” (COINAPO) (End date: May 2013) – MP0902. IFIN-HH is part of the romanian team involved in this project.