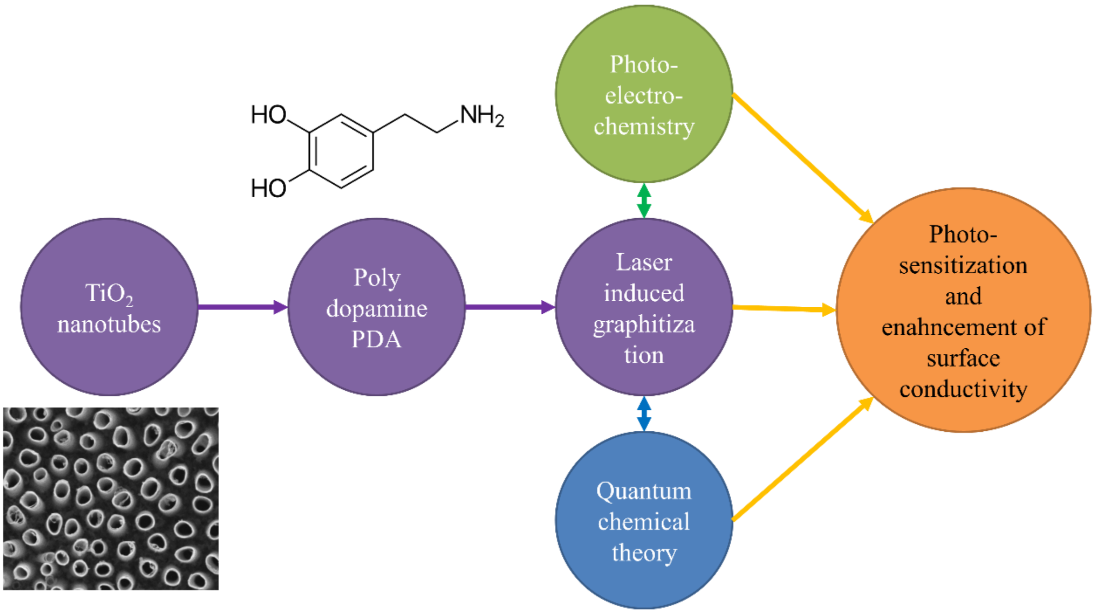
# Structure and photoelectrochemistry of the laser – graphitized polydopamine on $TiO_2$ nanotubes

## Popular-science summary

Reversal of the climate changes and reduction of the environmental pollutions are one of the greatest problems of modern science. Solving them requires multidimensional, long-term ventures one of which is switching from conventional to renewable energy sources. According to this idea, one of the most important missions of material scientists, condensed matter physicists, electrochemists is to manufacture efficient and low-cost energy conversion and energy storage devices with particular emphasis on solar energy harvesting. This energy can be utilized to generate photovoltage in solar cells or be used for **photoelectrocatalytic degradation** of pollutants. Typically, it is realized by nanostructured semiconductor materials - such as **titanium dioxide $TiO_2$** - and their heterojunctions, as well as electroactive or semiconductive polymers such as **polydopamine (PDA).** Performance and cost of the real devices are strictly dependent on the physics and chemistry of semiconductors and their junction; therefore, rigorous studies in this field are urgently required.

This project was created in connection with this worldwide paradigm towards building efficient, inexpensive, and green-chemistry strategies for semiconductor photosensitization. The main objective of this research project is **exploration of the photoelectrochemical properties of the laser-graphitized polydopamine (lgPDA)** electrodeposited on the surface of titania nanotubes (TNTs). It is anticipated that modification of nanotubes with polydopamine will increase their **photoactivity** and the laser exposure will change the electronic structure. As a result, their charge transfer resistance will be lowered (the **surface conductivity** will be enhanced). This combination is designed to optimize the efficiency of the material towards photocatalytic applications such as water splitting.

In the project, a **cutting-edge experimental techniques** will be used for characterization of photoelectrochemical properties of obtained materials. These include Incident Photon to Current Efficiency and Intensity Modulated Photocurrent Spectroscopy. These techniques will be coupled with a wide palette of **computational methods of density functional theory**. This coupling will ensure the connection between experimental results and the first-principles quantum chemical theories.




Conceptual diagram of the project.