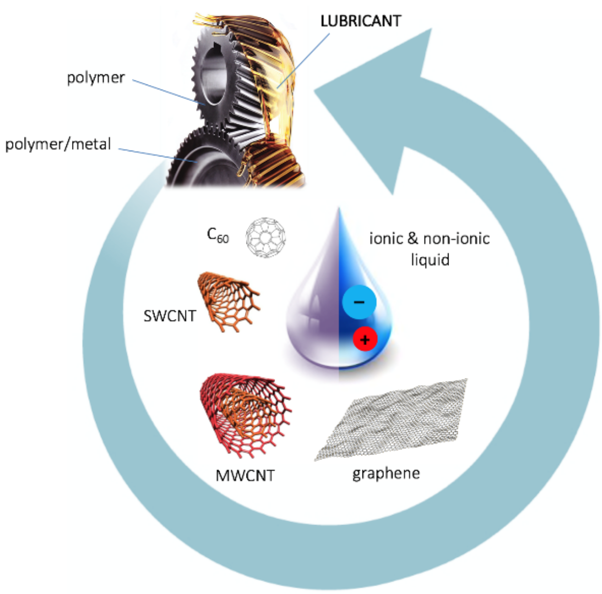
Carbon nanomaterials (CNs) such as carbon nanotubes (CNTs) and graphene reveal exceptional physical and chemical properties in many aspects outperforming numerous conventional materials. Thus, CNs attract world-wide scientific interest. One of the most notable CNs' properties is **superlubricity** – a state where the friction between two sliding surfaces nearly vanishes. Until now, this effect was confirmed in several studies, however, the vast majority of the measurements was performed in the nanoscale using electron microscopes – and for the surfaces as small as invisible for the unarmed eye.



In contrary to the above high-cost and time-consuming studies, our preliminary tests performed using a **tribometer**, and on the macro-scale surfaces, as large areas as for typical rotating and sliding machines parts, also confirmed **superior lubricating properties of CN-based liquids**. And so, when introducing our initially elaborated grease containing CNTs between plastic block sliding on the steel ring, we have observed friction incomparably lower than for any high-quality commercially available grease. Importantly, it should be noted that, nowadays, **plastic components** are extensively used in cars, aircrafts, home printers and practically any general application. Plastic sliding elements are used in inexpensive and simple mechanisms but critically in safety-relevant applications such as key elements of the car steering systems. In the future, **new class of lubricants** reducing friction and wear on plastic surfaces will make the field of CNs' applications even wider, eventually making the products broadly available, less expensive but more efficient.

What we have also observed was that the friction depended strongly on the CNTs' purity, type of the plastic sliding on the metal ring and type of the liquid in which CNTs were dispersed. Consequently, the goal of our project is **to develop and produce in the lab-scale lubricants containing CNs outperforming conventional greases in the reduction of friction on polymer surfaces**. Targeting this goal, we will apply ionic liquids and their solutions allowing us, from one hand, to obtain time- and operation-stable dispersions and to increase lubricant affinity to the sliding surface while maintaining their non-harmful character (both for surfaces as well as the environment), from the other hand. For the same reason we plan to modify the surface of CNs and to synthesize more complex, hierarchical structures basing on carbon nanomaterials, intentionally designed to reduce the friction.

We will apply **atomistic simulations** which are intended to provide an interpretative support for the experimental research. The planned simulations are meant to give insights into the molecular picture of lubrication and friction processes. This approach will allow us to identify and better understand physicochemical phenomena which occur in the considered lubricants. In next research step the numerically designed CNs will be produced in our laboratories. The proposed synthetic steps shall also allow the carbon atoms to **self-organize**. These 3D-organized CNs will be purified and modified predominantly using wet chemistry. Finally, functionalized CNs will be admixed to pre-designed liquids and tested in the tribometers. The plastic and metal elements from the tribometer will be comprehensively tested under microscopes like scanning electron microscope allowing us to understand details of the phenomena occurring on the sliding surface. One of the possible mechanisms of tribo-action emerges a permanent incorporation of CNs delivered with lubricants onto plastic surface making it more slippery. **The gained knowledge about the lubricant and plastic interactions will close the loop suggesting how to optimize CNs for the further friction lowering to the level of superlubricity.**