The problem of icing occurs in everyday life, e.g. in vehicles, airplanes, power lines, wind turbines, etc. The main aim of the project is to produce, characterize and investigate the properties of new anti-icing surfaces. They should show highly hydrophobic properties, reduce ice nucleation, and delay this process. The new surfaces will contain components that have never been used before: modern carbon nanomaterials (in particular, the pristine and hydrogenated carbon nanohorns and graphane) along with a terpolymer of tetrafluoroethylene, hexafluoropropylene and vinylidene fluoride (THV), never tested as the anti-icing material. Two trends are currently observed in the anti-icing science: surfaces with low and high Young's modulus are investigated. This is because all highly anti-icing materials have low Young's modulus (but not always the opposite), and, on the other hand, their practical application is hindered by their poor mechanical resistance. Hence, the concept of using the phenomenon of self-healing of surfaces from scratches and cracks formed after ice falling-off, as well as increasing the surface mechanical resistance by introducing carbon nanocoatings. In the project, THV will be used as the basic component of new self-healing anti-icing surfaces, including never studied in anti-icing science negative Poisson's ratio materials. Carbon nanomaterials, on the other hand, will be used as: coatings, components of new self-regenerating sponges/mats, polymer nanofibers (obtained by electrospinning) and surfaces containing pillars (obtained by photolithography). In this area, the recently discovered so-called Cassie's monostable surfaces are important. On the surface of such materials, the drop is stable, what is more, if, for example, the wind pushes it between the pillars, it (unlike most materials of this type) will not wet the surface. Once the external forces are gone, the drop spontaneously and reversibly returns to the Cassie's steady state. The results of the project's preliminary studies show that carbon nanohorns are perfect candidates as building blocks for the Cassie's monostable surfaces. We therefore hypothesize that Cassie's monostability may be key in designing the anti-icing properties. In addition, the project will use a new strategy to reduce Wenzel ice (frost) causing instability of the pillars. Another hypothesis we claim concerns the influence of adsorbed hydrocarbons present in the air on the ice nucleation process. Therefore, apart from mechanical tests and self-healing measurements, characterization of the chemical composition and hydrophobic properties of the newly obtained surfaces, we will perform freezing measurements (CAT tests, cryo-fracture SEM) in an atmosphere free of hydrocarbons, as well as simulation tests using Molecular Dynamics. Summarizing, we assume that: the use of nanographanes, carbon nanohorns (including the hydrogenated ones), fluorographene, carbon nanoribbons along with new fluorinated polymers will provide new anti-icing and self-healing materials, showing high hydrophobicity, protecting against ice nucleation, reducing the temperature of this process, and delaying the formation of ice, including frost. The new materials will bring us closer to the critical ice adhesion strength of 12 kPa, a value below which ice is removed by wind, its own weight or by vibration.