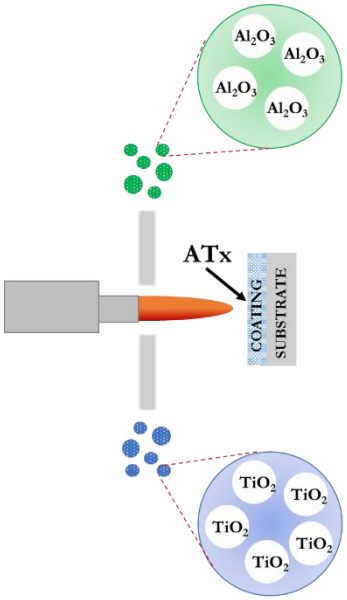
1. The objective of the project

In the recent years, surface engineering, particularly coatings technology, is of high interest of industry as a high attention is paid to the quality of products. The application of coatings provides many benefits, e.g. increase of different material properties like: strength, wear resistance, corrosion resistance, heat resistance, electrical conductivity and many others. One of the mainly used method are plasma spraying technologies, in which coating-forming material is melted in plasma jet and deposited on the substrate. The greatest potential for the development in this area reveals suspension plasma spraying (SPS) method, where the feedstock material (suspension) is a liquid. The suspension is the mixture of finely-grained powder (even of 1-3 orders of magnitude lower than those used for conventional thermal spraying), solvent and chemical additives. The use of suspension instead of conventional coarse powder allows forming finely-grained coatings of controlled thickness and unique properties, which do not occur in the same material in macro-scale.

Based on the previous studies, it is concluded that the chemical and phase composition of suspension significantly determine the spraying process itself, as well as the structure and properties of deposited coatings. The aim of this project is to produce multimaterial coatings with designed architecture which can be implemented into tailored applications. In many of them it is required to trade-off between several properties and that is where the use of hybrid coatings comes. **The novelty of this project will be design of wear-resistant Al_2O_3 + TiO_2 coatings, produced by plasma spraying from liquid feedstocks.**



ATx = Al_2O_3 + x wt.% TiO_2
x = 3; 13; 40

2. The scope of investigations

The planned investigations will be divided into three main stages: (i) characterization of the feedstocks and preliminary spraying trials, (ii) coatings deposition, (iii) microstructural characterization and studies of selected mechanical- and functional- properties of sprayed coatings. The completed tasks will allow obtaining complex data, related with e.g. feedstock type. Alumina-titania based coatings with different TiO_2 wt% addition will be investigated: Al_2O_3 + 3/13/40 wt% TiO_2.

The suspensions will be determined in the terms of Zeta potential, pH value, viscosity, as well as particle size distribution and phase composition. Taking into account the suspension characteristic in plasma jet, the full suspension plasma spraying process will be conducted. In the last stage, the deposited coatings will be investigated in order to determine their microstructure, phase composition and mechanical- (hardness, fracture toughness, adhesion, cohesion) and functional- (erosion resistance) properties.

3. Motivation of undertaken topic

It should be emphasized that the plasma spraying Al_2O_3+TiO_2 coatings was so far carried out by the deposition of micrometer-sized powder, by conventional atmospheric plasma spraying or by flame spraying. Liquid feedstock spraying is possible but still investigated and rather rarely described in the literature (when comparing to e.g. thermal barrier coatings and solid oxide fuel cells). The SPS method, proposed in this project, is one of the newest techniques of thermal spraying (patented in 1997). On one hand, it proves the validity of proposal (topic is innovative and developing), but on the other – this complex process is highly dependent from many variables, which is not fully understood yet (including also hybrid suspensions injection, proposed in this project). Basing on the previous studies, it is suspected that the analysis of the feedstock injection will increase the repeatability and the accuracy of process control. In this way, the implementation of SPS method could be possible in the wider range of possible applications and the transfer of this technology to the industry could be impelled.