Nowadays, we must face plenty of environmental and energetic problems. Air pollution, microplastic and chemical contamination, and lack of sustainable energy resources are problem for both developing and developed countries. Raising demand for air and water purificators, self-cleaning and self-disinfecting surfaces (enhanced by Coronavirus pandemic), caused a strong increase in interest in phenomenon of photocatalysis. This process, consisting in substances' degradation under light influence, is often recognized as viable solution for environmental, energetic, and even medical problems. Photocatalytic coatings are now under intense research for pollutants degradations (including microplastic utilization), viruses' deactivation and wastewater decontamination applications, and results are highly promising. However, methods used for deposition of photocatalytic coatings are often energy- and time-consuming. Moreover, deposition on large and complex geometries is challenging. These problems **cause a need for searching of alternative methods.**

A promising alternative method for photocatalytic coatings' deposition is plasma thermal spraying process. Already conducted research proved, that plasma spraying can be successfully used for deposition of TiO_2, most popular among photocatalysts due to its nontoxicity and low cost. However, photocatalytic properties of pure TiO_2 are limited to high-energy UV irradiation. To expand this range, different modifications are proposed and addition of different semiconducting material to form a composite-like structure called heterojunction is one of most promising one. Numerous studies shown that photocatalytic activity of resulting structure is often higher than materials used to create it alone.

Deposition of heterojunction could be possible in simple, one-step procedure by Hybrid Plasma Spraying (HPS) process. In contrary to conventional plasma spraying, hybrid plasma spraying allows simultaneous spraying of two or more different feedstocks in terms of chemical composition and/or feedstock's form (powder, suspension, or solution). Moreover, compared to methods currently used for photocatalytic coatings' deposition, environmental footprint of plasma spraying is significantly lower, and its' efficiency is greater. HPS stands as relatively new technique, which applications are still unexplored, and to the best of authors' knowledge, **none research on this topic was conducted yet.**

In proposed research, possibility of photocatalytic heterojunction deposition by Hybrid Plasma Spraying process will be examined. The studies will include feedstock preparation and characterization, preliminary spraying experiments and deposition of final coating. As a result, TiO_2/SnO_2 and TiO_2/ZnO heterojunctions will be created, and properties of deposited coatings will be compared to suspension plasma sprayed pure TiO_2. Apart from photocatalysis, phase and chemical composition, as well as coatings' morphology will be examined. Moreover, selected mechanical properties of deposited coatings will be tested. Impact of feedstock properties, materials ratios and process parameters on coatings' properties will be established. Graphical representation of proposed study is shown in Figure 1.

With no similar research described yet, an alarming knowledge-gap is remaining. With this research, a promise of bridging it appears. We believe that our study may significantly **contribute to acceleration of implementation photocatalytic surfaces to manufacturing industry** and further allow eco-friendly and relatively cheap pollution utilization on an industrial scale.

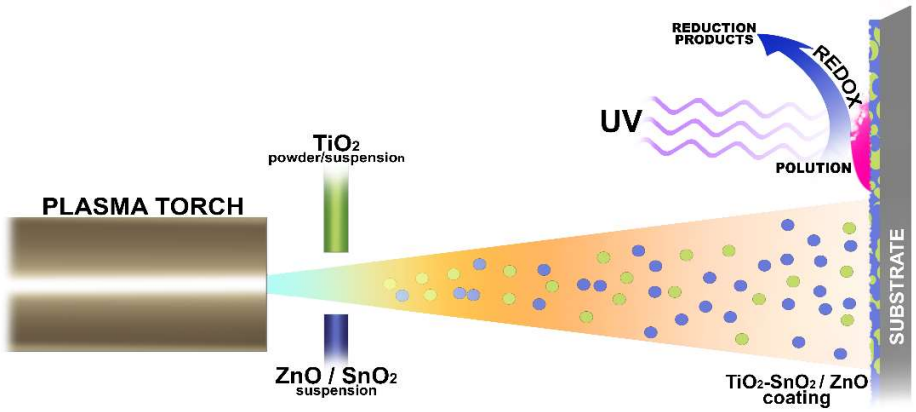

Figure 1: Hybrid Plasma Spraying of TiO_2-ZnO / TiO_2-SnO_2 photocatalytic coating scheme.