Project PREMISE

Fate and evolution of particles in marine environment (WP2)

- **Task 2.1**. Experimental analysis of the microparticle evolution. In the rain erosion tests (RET), the particles from eroding samples are collected, and evaluated (sizes, shapes, distributions). The data are used to validate and fine tune the model of erosion. The microplastics are created in a test chamber, which allows their collection and concentration down to 0.5…1 µm in size. This is achieved by filtering the water on sintered steel filters. The water used for the creation is ensured free of anthropogenic particles and the chamber is constructed so it does not itself contribute interfering particles. This is tested by 'dry runs' conducted on items made of non-erodible materials and represents blank values for the production process. Microplastics created from several types of materials (polyurethanes, polyesters, multilayers…) are studied.

- **Task 2.2.** Degradation of microplastic particles in marine environment. Particles are characterized by spectroscopic imaging, and their chemical composition and degradation state compared to that of the materials subjected to artificial environmental stresses. These particles represent virgin microplastics immediately upon release from the wind turbine. Once in the marine environment, they can be further degraded by chemical, physical, and biological processes. The chemical degradation of plastics can cause potentially toxicity. The type and degree of degradation depends on the material of the particles, their additives, and how long they are in which environmental compartment, and will be investigated in this task. Microplastic degradation is studied under controlled and accelerated conditions simulating surface waters and the mechanical and chemical stresses occurring here. The state of the particles is assessed by a combination of flow imaging microscopy and µRaman. This compartment is expected to be the harshest towards the microplastics, inducing the most degradation. However, much of the impacts can be expected in bottom sediment where microplastics accumulate and high concentrations can be reached.

- **Task 2.3**. Microplastics in sediment. The fate of the microplastics in sediment is also studied, where particles are incubated in sediment under aerobic and anaerobic conditions for durations up to a year. Upon incubation, they are extracted using gentle extraction methods and analyzed by flow imaging microscopy and µRaman. Sediment is a sink for microplastic with concentrations several orders of magnitude above what is found in water. Benthic organisms are hence subject to significantly higher microplastic concentrations than pelagic organisms. At the same time, wind turbines are hotspots for microplastic formation, and relative high sediment concentrations can hence be expected in their vicinity. Finally, the impact of biofilm development on the microplastics is studied by incubating the particles for several months under environmentally realistic conditions corresponding to different water depths. The particles are then gently extracted and analyzed by flow imaging microscopy and µRaman.

Expected results: Evaluation of evolution and distribution of plastics in marine environment.