

Project PREMISE



Scale of the problem: How significant is this problem? (WP1)

- **Task 1.1.** Listing and classification of list of polymers used currently for wind turbine protection (polyurethanes, polyesters, thermoplastics, combination with thermosets...). Data base of mechanical properties and market volumes of the coating groups.
- **Task 1.2.** Prediction of eroded particles volume. Development of computational model for the rain erosion prediction, depending on location and coating material. The computational model is based on finite element modelling of coating surface degradation, damage modelling and realistic rain scenario [1]. The liquid impact on the blade coating is simulated using two methods, Lagrangian–Eulerian model of liquid/solid interaction, and smoothed-particle hydrodynamics (SPH) method what allows the simulation of stress field in blade under each rain drop impact [9]. The damage evolution is described using the statistical (rainflow counting) fatigue model of polymer degradation. The viscoelastic properties of the material are taken into account in the material model. The output will be the rate of material removal, volume of eroded material, average particle size and variation of particle sizes, formed due to the blade erosion, as a function of rain and hail conditions and material properties. The computational model will be validated using the RET (Rain Erosion Testers) installed at DTU Wind. Comprehensive RET testing of representative coatings is carried out, the particles are collected (with water, separated) and investigated.
- **Task 1.3.** Effect of weather/rain conditions and coating types. Effect of rain and weather conditions on the microplastic pollution is investigated. Volume of various eroded materials coming in sea water, depending on age of installed wind turbines (older vs. newer coatings) and manufacturers (for instance, LM Wind uses polyesters, while many others use polyurethanes-based) are determined. The influence of various coatings (polyurethanes, multilayers, epoxy...) on the amount of microplastics, size of particles, frequency of detachment is evaluated using the model from Task 1.2.

Expected results: Predictive model of wind turbine coating erosion and evaluation of polymer particle (size, volume,..) falling into sea. Evaluation of overall volume and expected growth of plastics/microplastics in sea over next years.

Milestones:

- M1.1. Estimation of volume of marine pollution due to wind turbine erosion (DTU, M20)

Deliverables:

- D1.1. Data base of polymer group, their properties and market volumes (DTU, M12)
- D1.2. Predictive computational model of plastic pollution due to the blade erosion (DTU, M24)
- D1.3. Influence of materials used and predictions on the future of plastic pollution with offshore wind expansion (DTU, M30)

