Antibiofouling Coatings

Reinventing transparent coatings for combating biofouling of marine sensors

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Background and motivation

Materials submerged in sea water experience a series of biological and chemical processes, resulting in the formation of complex layers with attached organisms known as biofouling. The growth of micro-nano organism on marine sensors became a serious issues for underwater sensors those are widely used for monitoring the information on seawater quality, and marine aquaculture, etc [1]. Therefore, novel sustainable antifouling materials that can be used in marine sensors should be developed.

I wish to create a bridge between the laboratory and fieldwork approaches through my research. Therefore, I am particularly attracted to this MSCA-SEAS program managed by UiB, which aims to recruit experienced researchers to promote interdisciplinary knowledge for a more sustainable marine future. I believe that my research experience gained by working in different working environments in different countries can help in building new strategies for the mitigation of fouling organisms to enhance the life of marine sensors.

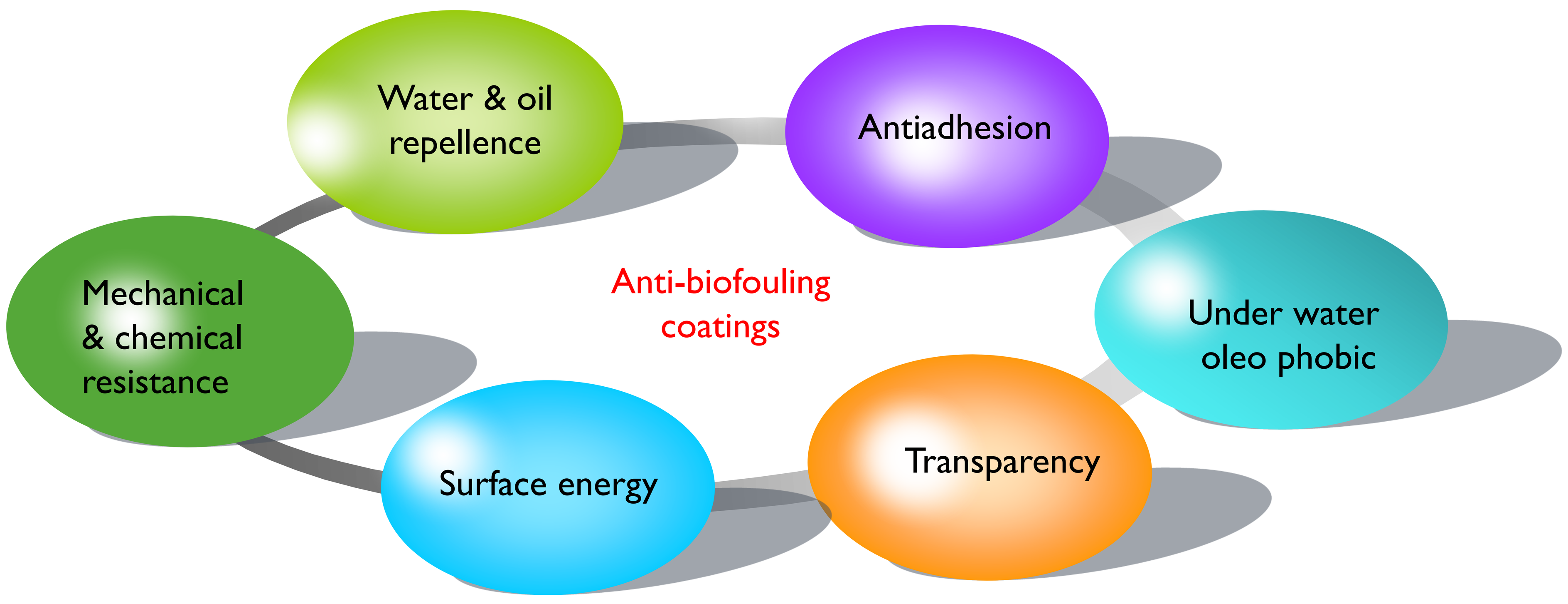
Project description

The main goal of this proposal is to develop a nontoxic antibiofouling coating system for marine underwater sensors. This multidisciplinary project aims to develop an antibiofouling coating, which provides long-term fouling resistance and enhances the lifespan of both optical and nonoptical marine sensors. This study involves the examination of the physical, chemical, and mechanical properties of coatings, including surface topography, surface free energy, hydrophobic and hydrophilic nature, etc. This antibiofouling coating must be substrate independent, compatible with marine sensors, and environmentally friendly. The project includes investigating the effect of antifouling coating on the communication system of diverse optical and non-optical marine sensors and exploring the commercial aspects of successful antifouling materials.

Main questions

- What is the best design for fabrication of antibiofouling coatings to achieve the high contact angle for water and oil liquids with high transparency of minimum 80% ?
- How to improve the mechanical robustness, chemical resistance, and corrosion protection of the coatings ?
- How to enhance the antifouling performance of the surface by measuring the bacterial adhesion and biofilm assay ?
- How to increase the signal quality of smart sensor devices at the SFI smart ocean centre ?

Development of antibiofouling coatings



Physicochemical properties of antibiofouling coatings

Marine sustainability

- The proposed coating will improve the quality of real-time measurements and long-term data collection required for the systematic monitoring of parameters at different water locations over time.
- The use of the proposed coating can help maintain long-term sustainability in the petroleum industry, offshore and power industry, aquaculture, and other environmental monitoring activities, including the measurements of turbidity, oxygen levels, CO_2, methane, pH, pressure, current, and noise.
- In addition, the research will help understand physical processes such as sea-ice formation, animal behaviour, and position concerning in-situ environmental conditions as well as the interface between physics and biology.

Aims (and/or milestones)

- To design and select suitable antibiofouling materials based on wettability, surface free energy, transparency, fouling release property, and substrate adhesion;
- To enhance the antifouling performance against laboratory made fouling organism added seawater
- To evaluate the effect of the antibiofouling coating on the communication system of smart sensor devices at the SFI smart ocean centre and NORCE as well.

Transmissometer after 40 days in Trondheim harbor (Norway) [2]

Impact

This can result in significant economic, environmental, and social benefits. Such benefits will be applicable to the public and society at large in terms of an increase in the lifetime of sensors and their ability to deliver real-time data without requiring frequent maintenance.

Supervisory team

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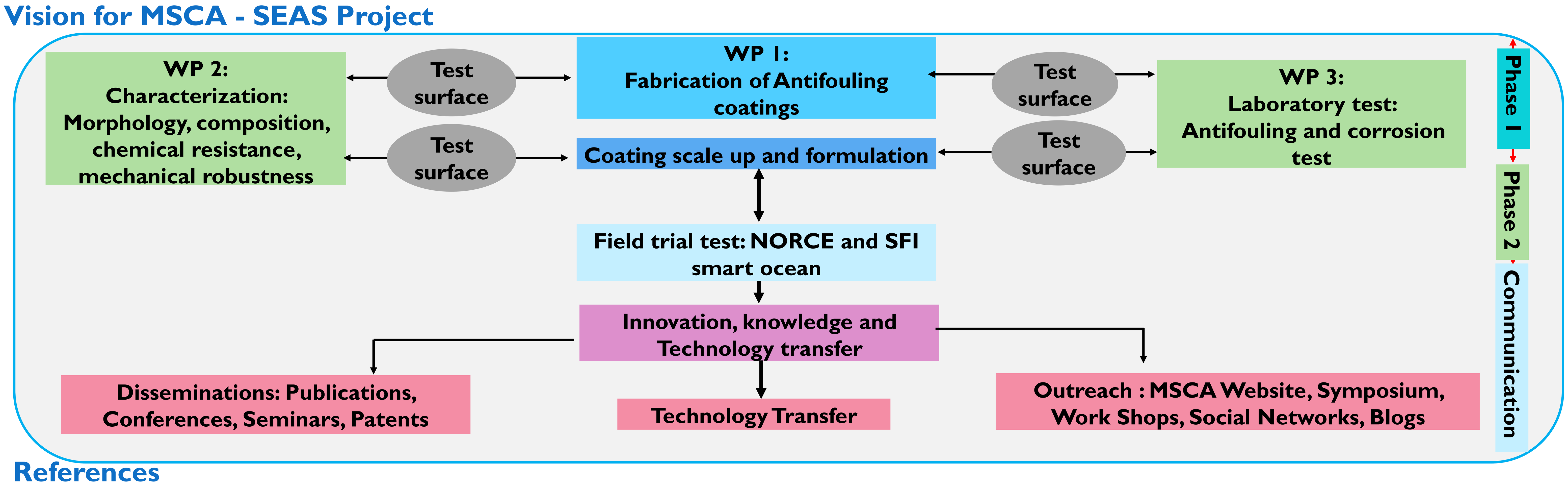
Vision for MSCA - SEAS Project



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References

1. Adrián Delgado , Ciprian Briciu-Burghina and Fiona Regan, Antifouling Strategies for Sensors Used in Water Monitoring: Review and Future Perspectives, Sensors 2021, 21, 389.
2. L. Delauney, C. Compère and M. Lehaitre, Biofouling protection for marine underwater observatories sensors, Oceans 2009 – Europe, 2009, Pages 1-4