Antibiofouling coatings

Development of environmentally benign biofouling-free coatings for oceanographic sensors

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Background and motivation

The development of unwanted biofilms on sea-submerged surfaces initiates corrosion, shortening engineered components' lifespan and failure. The challenge of effectively preventing biofouling formation without introducing toxic substances into the aquatic environment has driven research to develop alternative, biocide-free technologies. Especially, for oceangraphic sensors, biofouling has long been considered a limiting factor and is recognized as one of the main obstacles to autonomous environmental monitoring in aquatic environments[1, 2].

Through my research, I wish to create a bridge between laboratory and fieldwork approaches. Therefore, I am particularly attracted to this MSCA-SEAS program managed by UiB, which aims to recruit researchers to promote interdisciplinary knowledge for a more sustainable marine future. I believe that my research experience can help to build new strategies for mitigating fouling organisms to enhance the life of oceangraphic sensors.

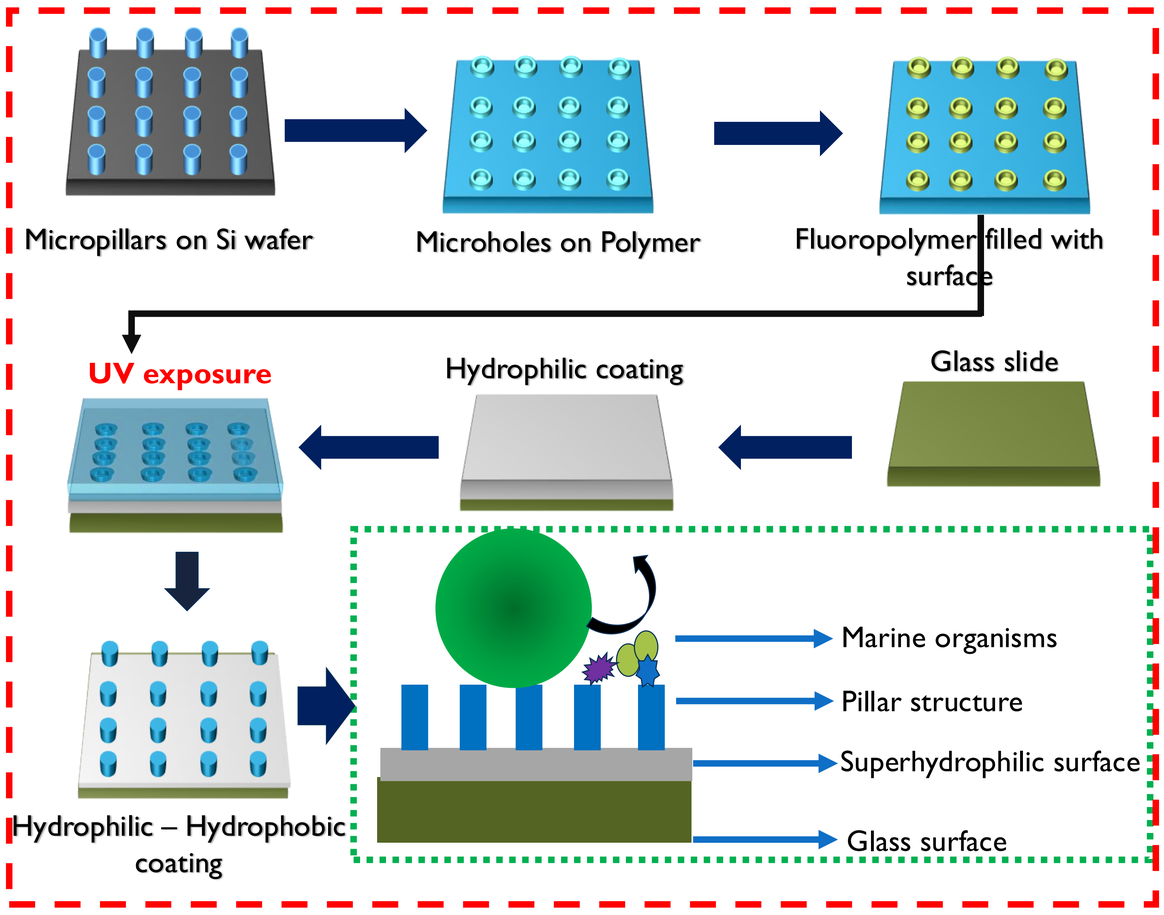
Project description

The main aim of this project is to develop an environmentally friendly anti-biofouling coating system for oceanographic sensors. The key objectives of this multidisciplinary project are to reinvent anti-biofouling coating, which offers long-term prevention of fouling organisms and enhances the lifespan of both optical and nonoptical marine sensors. furthermore, this project includes field trial studies to understand the effect of antifouling coating on the communication system of diverse optical and non-optical marine sensors and explore the commercial aspects and robustness of coatings

Main questions

- How to fabricate high transparent (more than 80%) superamphiphobic antibiofouling coatings?
- How to enhance the robustness, and corrosion resistance of the coatings?
- How to enhance the antifouling performance of the surface by measuring bacterial growth and adhesion?

Development of antibiofouling coatings



Selection of materials and strategies

- ✓Currently known anti-biofouling materials
- ✓Marine sensor coating and housing materials
- ✓Impact of coating on marine sustainability
- ✓Surface energy and hydration ability of the materials

- ✓ Bio-inspired technique
- ✓Surface wettability and transparency
- ✓Physical and chemical strategies
- ✓ Field trial tests

SEA-IMMERGED BIOFOULED SURFACES AT AUSTEVOLL

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.

Marine sustainability

- The coating can help maintain long-term sustainability in the 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.
- This 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.
- This research will facilitate understanding sea-ice formation, animal behavior, and position concerning in-situ environmental conditions as well as the interface between physics and biology.

Supervisory team

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Publications (Journal articles)

1. Paul Thomas, **Bichitra Nanda Sahoo**, Peter James Thomas, Martin Møller Greve, Recent advances in emerging integrated anticorrosion and antifuling nanomaterials based coating solutions, **Environmental Science and Pollution Research**, **2024**, https://doi.org/10.1007/s11356-024-33825-6.

2. **Bichitra Sahoo**, Peter Thomas, Paul Thomas, and Martin M. Greve, Antibiofouling Coatings For Marine Sensors: Progress and Perspectives on Materials, Methods, Impacts, and Field Trial Studies, **communicated to ACS Sensors**, September 2024.

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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, 1-4

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