The Convergence of Living Essence and Engineered Innovation

NextGen Materials 2025

Book of Abstracts

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Exploring material-biofilm interface: towards bioluminescent coating systems

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The BIOLUMICOAT project investigates the development of engineered living coatings that integrate microorganisms into architectural surfaces to achieve adaptive, responsive, and sustainable performance. The long-term vision is to create bioluminescent coatings, where microbial consortia act as natural light emitters while also providing protective and decorative functions.
To move towards this goal, current work focuses on preliminary studies of material–biofilm interfaces. Within BIOLUMICOAT, protocols are being established for the characterization of microbial colonization on substrates such as wood and concrete. Synchrotron-based microtomography has been applied as a non-destructive technique to visualize biofilm formation and hyphal penetration, demonstrating the feasibility of 3D imaging for studying interface processes.
These early steps highlight the importance of developing reliable methods for interface characterization, which will serve as a foundation for future functionalization. By advancing protocols for studying material–biofilm interactions, BIOLUMICOAT lays the groundwork for integrating microbial systems into coating technologies. This methodological progress supports the long-term development of bioluminescent engineered living coatings, contributing to the advancement of Engineered Living Materials (ELMs) and aligning with the European Green Deal (Fig. 1).

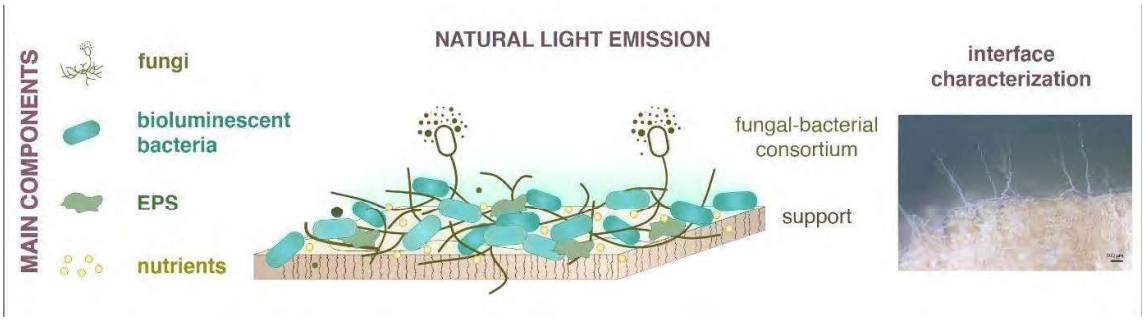

Figure 1. Schematic representation of the BIOLUMICOAT concept. Fungal–bacterial consortia supported by a substrate form biofilms with the desired functionality of natural light emission. The image on the right illustrates biofilm development on the wood substrate.

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