SanFlex - Antipathogenic Touchscreen Polymer Films

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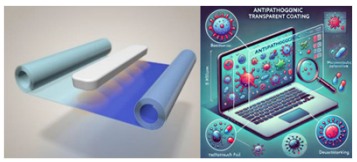
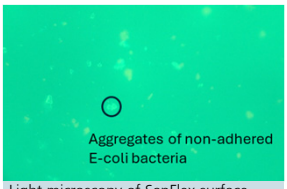
Motivation

About 4 million people per year acquire health associated infections (HAIs) in Europe. Antipathogenic films can help to reduce transmission of HAIs. The SanFlex project develops an antipathogenic film coated with a superacid catalytic material intended as protective cover films on touchscreens, containing only benign materials. The project lays the foundation for roll-to-roll production of antipathogenic biopolymer protection films for touchscreens and beyond.



The antipathogenic action of the films is realized by acidifying a titania coating, which is synthesized by a low temperature strategy using high-power impulse magnetron sputtering to grow crystalline-seed precursor films, followed by Flash Lamp Annealing (FLA) for further crystallization. Reactive gas-phase photo-fixation has been demonstrated to achieve bonding of sulphate groups on the crystalline surfaces. The process strategy is compatible with the growth of low-cost polymers. The FLA technology exhibits inline capability enabling large area production.

The socio-technical assessment ensures that user needs and healthcare processes as well as market demand and the competitive landscape are taken into account. It also considers ethical and social implications of the technology. The ecological assessment identifies environmental hotspots that serve as starting points for improvement measures, using the SIMPL method for scenario-based inventory modelling.



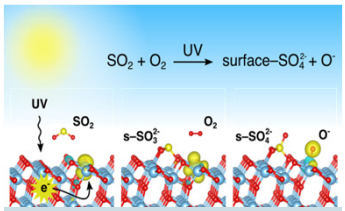
Light microscopy of SanFlex surface after exposure to E-coli bacteria

The films are both photocatalytic (TiO_2) and superacid (SO_4-TiO_2) exhibiting oleophobic properties [1]. Third-party testing by Prof. Barbara Bażanów and Aleksandra Pogorzelska at University of Environmental and Life Sciences in Wrocław shows antiviral (>99.99% for adenoviruses) and microbiostatic properties.

Potential users in healthcare welcome the film's improved antipathogenic properties but require adjustments in current hygiene protocols to maximize benefits.

750 mm inline FLA module

- High-Power Impulse Magnetron Sputtering (HiPIMS) for direct deposition of nanocrystalline thin film seeds on temperature sensitive polymers
- Flash Lamp Annealing (FLA) as an inline capable crystallization method for the use of polymers
- Setup of inline capable reactive gas-phase photo-fixation process

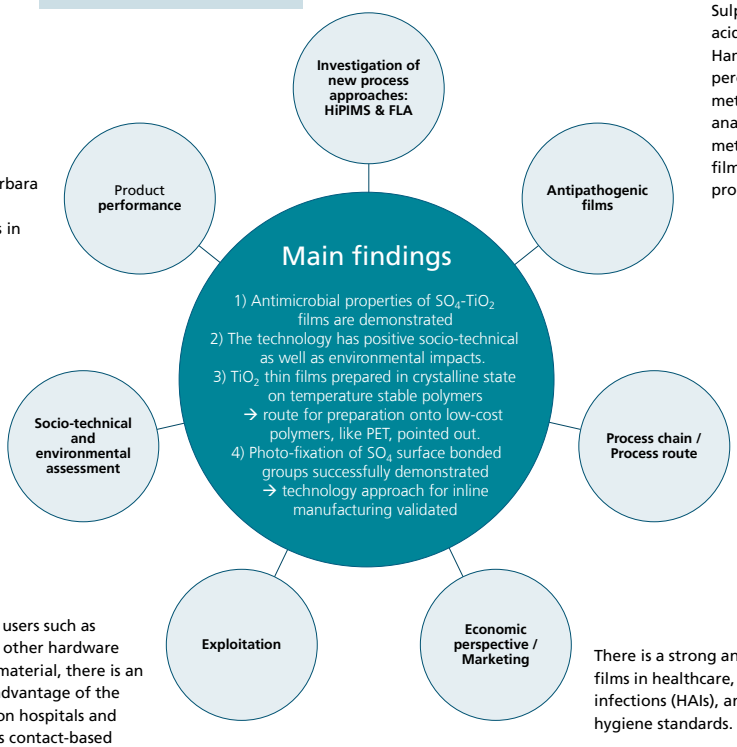


Formation of sulphated titania coatings [2]

Sulphated titania (SO_4-TiO_2) is a well-known acidic compound that exhibits superacidity; the Hammett acidity is about −14 (higher than e.g. perchloric acid -13). We have developed a method to synthesize SO_4-TiO_2 on the surface of anatase TiO_2 films by a UVA light-assisted method compatible with FLA that render the films photocatalytic and advanced wetting properties [1,2].

Sheet-to-Sheet / Roll-to-Roll coating equipment

To bring the technology into relevant dimensions the up-scaling to pilot-scale industry level by large area magnetron sputtering and inline flash lamp annealing has been investigated and demonstrated.



With the market growing rapidly and several users such as hospitals, manufacturers of touchscreens and other hardware etc. expressing a keen interest in testing the material, there is an ambitious exploitation plan in place to take advantage of the impressive results achieved. A first priority is on hospitals and care providers in the Nordics and Germany. As contact-based pathogens are also spread through surfaces outside of healthcare settings, where much lower hygiene standards exist, several discussions are also ongoing with potential future users, regarding post project exploitation activities.

There is a strong and growing market for antimicrobial plastic films in healthcare, driven by concerns about hospital-acquired infections (HAIs), antibiotic-resistant bacteria, and improved hygiene standards.

The global antimicrobial plastics market was valued at approximately USD 3.5 billion in 2023, reaching approx. USD 6.8 billion by 2032 (a CAGR of 7%) during the forecast period. The healthcare sector is a significant contributor to this market, accounting for approximately 31.46% of the antimicrobial plastics market in 2024.

References

[1] Z. Topalian, et al., ACS Appl Mater Inter 2012, 4, 672-679; Z. Topalian, et al., Thin Solid Films 2009, 518, 1341-1344
[2] Langhammer, J. Kullgren, L. Österlund, J. Am. Chem. Soc. 2020

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