Background and IP

Laccases are easily manufactured, free of endotoxins and do not require any cofactors for enzymatic activity. Laccases from fungi are enzymes presently used in large scale in the pulp industry. A collaborative of Fraunhofer Institutes to apply these enzymes for surface modifications has led to numerous discoveries on the action of these enzymes on surfaces.

Key publications

- Figueiredo Macedo de Lima J, Aguiar Jordao Mainardi M, Puppin-Rotani M, Pereira Rodrigues-Filho U, Suzy Liporoni P, Calegaro M, Rischka K*, Baggio Aguiar F. Bioinspired catechol chemistry for dentin remineralization: A new approach for the treatment of dentin hypersensitivity. Dent. Mater. 2020, 36, 501-511.
- Corrales Ureña YR, Souza-Schiaber Z, Lisboa-Filho PN, Marquenet F, Noeske PLM, Gätjen L, Rischka K. Functionalization of hydrophobic surfaces with antimicrobial peptides immobilized on a bio-interfactant layer. RSC Advances 2020, 10, 376-386.
- Macul Perez F, Corrales Ureña YR, Rischka K*, Leite Cavalcanti W, Noeske PLM, Safari AA, Wei G, Colombi Ciacchi L. Bio-interfactants as double-sided tapes for graphene oxide. Nanoscale 2019, 11, 4236-.4247.
- Brinkmann A, Szardenings M, Rischka K. Enzyme ersetzen Plasmabehandlung. J. fuer Oberflaechentechnik, 2018, 58, 32-33.
- Corrales Ureña YR, Leite Cavalcanti W, Soltau M, Vollabos K, Rischka K, Noeske PLM, Brune K, Dieckhoff S. Interfactant action of an amphiphilic polymer upon directing graphene oxide layer formation on sapphire substrates. Appl. Adhes. Sci. 2017, 5, DOI: 10.1186/s40563-017-0089-5.
- Corrales Ureña YR, Gaetjen L, Vieira Nascimento M, Lisboa Filho PN, Leite Cavalcanti W, Noeske PLM, Rischka K. Investigations of biofilms formed on silica in contact with aqueous formulations containing laccase and maltodextrin. Appl. Adhes. Sci. 2016, 385, 216-224.
- Corrales Ureña YR, Lisboa-Filho PN, Szardenings M, Gaetjen L, Noeske PLM, Rischka K. Formation and composition of adsorbates on hydrophobic carbon surfaces from aqueous laccase-maltodextrin mixture suspension. Appl. Surf. Sci. 2016, 385, 216-224.

Patents

- Composite with improved paint adhesion and method for producing the same, EP3009469 (B1)
- Method for marking or immobilizing a target structure, EP2895858 (B1), WO2014041126 (A1), CA2885036 (A1), US9193986 (B2), DE102012216346 (A1)
- Composite with improved paint adhesion and method for producing the same, DE102014221181 (A1), EP3009469 (A1)
- Method for activating a surface by increasing the hydrophilicity and/or for binding target structures, US2015159150 (A1), CA2876560 (A1), DE102012210163 (A1), EP2861731 (A1), WO2013186392 (A1)

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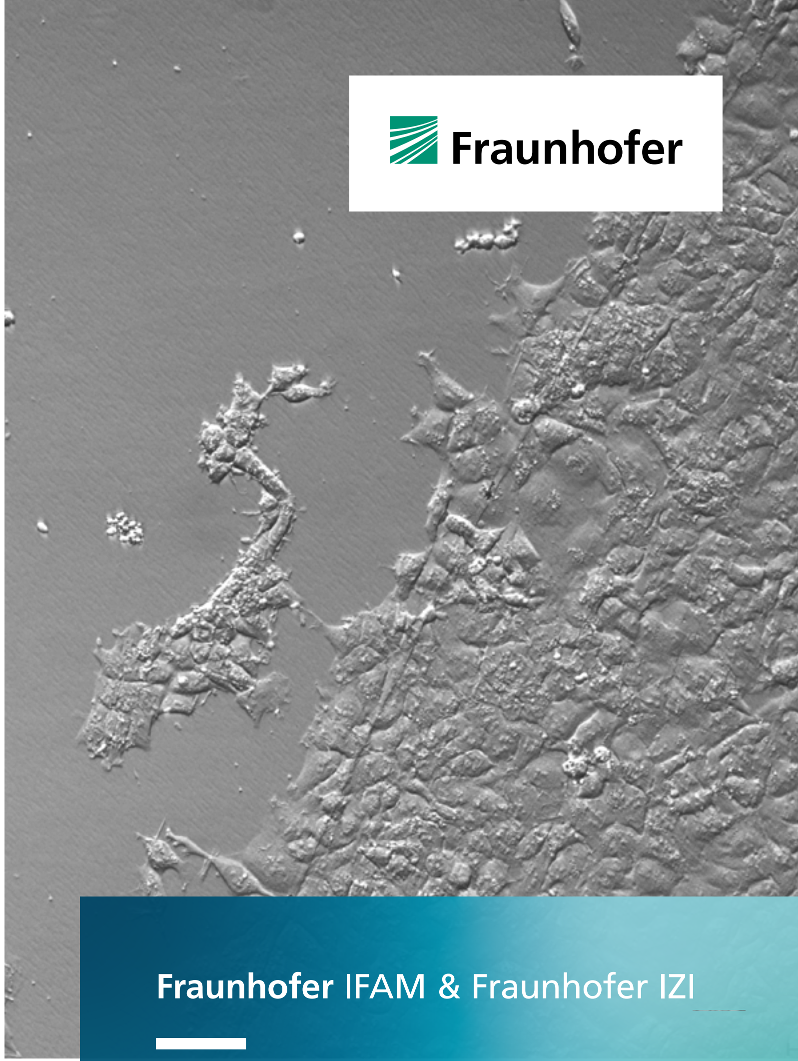

Fraunhofer

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L-act: Making hydrophobic surfaces wettable

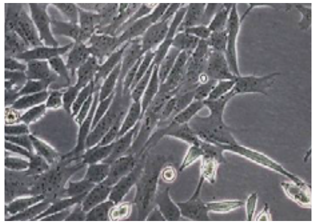
Trametes versicolor. © Travelli/iStock

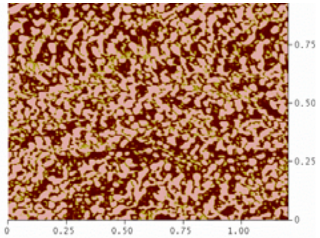
L-act: Making Hydrophobic Surfaces Wettable

Because of the low surface energy of these materials a direct application of adhesives or lacquers on these surfaces is difficult without surface pretreatments like plasma, pickling or corona treatment. This type of modification is really a **“green”** chemistry.

Examples

- Polystyrene (PS)
- Polypropylene
- Polyethylene (PE)
- TOPAS®*
- PEEK
- Polycarbonat (PC)





Phase contrast image of L-Act treated PE surface

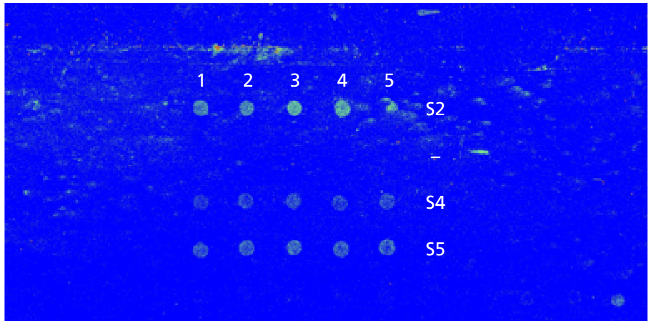
Life Science

It is still a prevailing challenge to grow cells in culture under conditions close to those in their normal tissues. Most cell lines will require a surface they can attach to. Usually plasma is used to modify organic polymer surfaces. However this method requires a lot of energy and on cellular scale it leaves a surface often uneven and not well defined.

L-act has been successfully tested on all polymers investigated so far. It will equally well activate planar surfaces as well as the interior of scaffolds. This allows using identical surface activation for any material appropriate for the actual task (e.g. microscopy and arrays (TOPAS®*), freezing (PP), artificial tissues (PS, PP, PE, polyesters)) and selective hydrophilicity modifications in microfluidics. Calculations show that the method is economic as well as versatile allowing easily additional modifications like defined charges etc.

Examples

- Cell culture dishes
- Scaffolds
- 3D-structures
- Medical implants
- Peptide arrays or similar on inert surfaces



Peptide arrays on TOPAS®: Ultrasensitive due to lack of background in L-act modified TOPAS slides.

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Material Sciences

Polymer based materials are applied in many industrial fields due to weight reduction. For this reason polyolefins like polypropylen, -ethylen and polystyrene, PEEK and polycarbonate are commonly used. A direct application of adhesives or lacquers on these surfaces is difficult without surface pre-treatments. The L-act technology is a low energy consumptive and environmental friendly process, which doesn’t require high money investment for complex application machines.

Examples

- Automotive industries
- Aerospace industries
- Rail vehicle industries
- Other applications of glues and paints

** TOPAS® is a registered trademark of TOPAS Advanced Polymers*