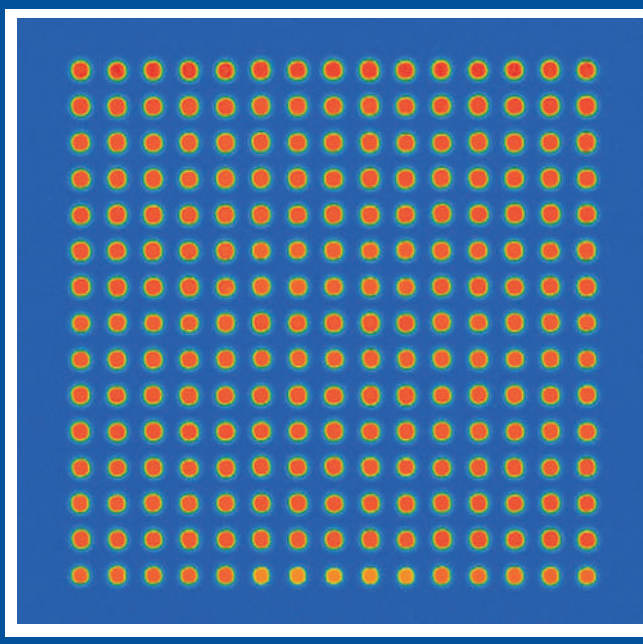
www.poly-an.de

Functionalised Microarray Slides



PolyAn

molecular surface engineering

Molecular Surface Engineering since 1996

PolyAn
molecular surface engineering

PolyAn is a nanotechnology company specialised in the modification of surfaces using Molecular Surface Engineering (MSE). Since 1996 PolyAn develops and manufactures high-performance consumables for multiplex diagnostics and Life Science research.

Microarrays

PolyAn is one of the leading producers of functionalised substrates for microarrays. Our wide range of surfaces, substrates and handling tools for microarrays enables our customers to select the most suitable substrate for their specific application.

Microparticles

PolyAn is offering a portfolio of monodisperse PMMA (poly methyl methacrylate) microparticles (beads) for multiplex bead assays, calibration of flow cytometers and calibration of fluorescence imaging systems. PolyAn's microparticles can be colour encoded with a wide range of fluorescent dyes and functionalised with PolyAn reactive 3D-matrices.

Functionalised plates for Immunoassays

PolyAns Amine-binding microplates are used for immobilising biomolecules that inefficiently coat by passive adsorption. PolyAn offers amine-binding surfaces, providing a convenient method to covalently immobilise biomolecules.

Calibration tools for fluorescence imaging systems

Re-usable calibration tools for fluorescence based detection systems. PolyAn's calibration slides for cell assays are for example used as quality controls in a number of IVD systems for immunology applications

Molecular Surface Engineering Services: PolyAn is able to equip almost any substrate with our reactive matrices for selective immobilisation and antifouling surfaces for the reduction of cell adhesion and unspecific binding, respectively. As part of our Molecular Surface Engineering services, we offer functionalised consumable and substrate materials for OEM applications, which are tailored to specified customer requirements.

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Product Overview

PolyAn is proud to offer one of the broadest product portfolios for microarray substrates on the market. Our products include plastic and glass slides, metal and metaloxides as well as functionalised 96-well plates for various microarray applications.

Surface modifications

Glass Slides & Coverslips

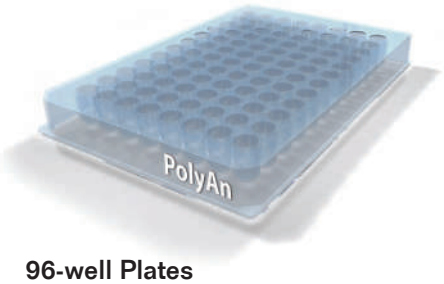
- 3D-Epoxy
- 3D-Amino
- 3D-Carboxy
- 3D-Aldehyde
- 3D-NHS
- 3D-PDITC
- 3D-Maleimide
- 3D-Thiol
- Poly-L-Lysin
- Streptavidin
- Neutravidin
- 2D-Epoxy
- 2D-Amine
- 2D-Carboxy
- 2D-PDITC
- 2D-Azide
- 2D-Thiol

Polymer Slides

- 3D-Epoxy
- 3D-Amino
- 3D-Carboxy
- 3D-Aldehyde
- 3D-NHS
- 3D-PDITC
- 3D-Maleimide
- 3D-Thiol
- Poly-L-Lysin
- Streptavidin
- Neutravidin

96-well Plates

- 3D-Epoxy
- 3D-Carboxy
- 3D-NHS
- Streptavidin
- Neutravidin



We offer customised slides with a surface modification tailored to your specific application. PolyAn also functionalises coverslips and SPR (Surface Plasmon Resonance)-surfaces with our 3D-reactive matrices.

PolyAn is the European distributor of Grace Bio-Labs' Nitrocellulose slides, SecureSeal™ and ProPlate™ product families.

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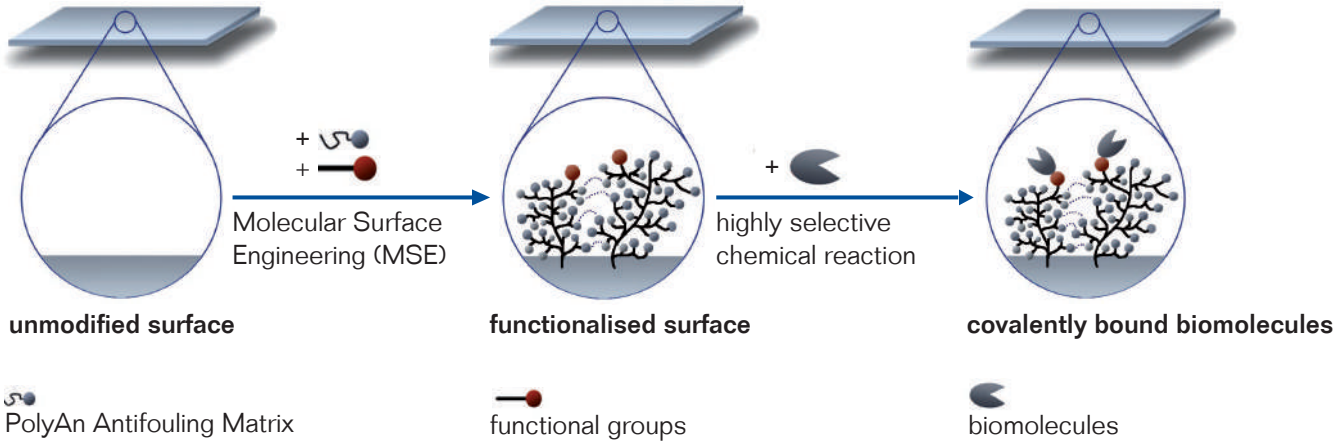
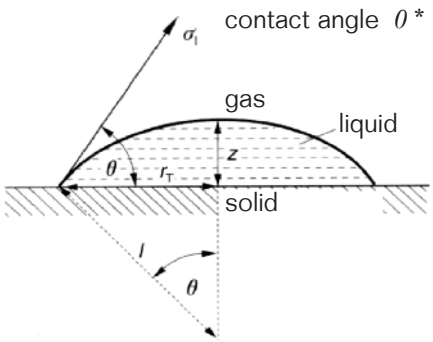
Molecular Surface Engineering (MSE)

PolyAn's high-performance Microarray Slides are functionalised with a **3D surface chemistry** comprised of a long-chain polymer containing a defined number of reactive groups. This polymer is covalently linked to the surface of the slide.



Our MSE-technology gently binds the functional layer onto the surface without damaging the base substrate. The morphology of the functional surface and thus the number of the reactive groups can be fine-tuned within a narrow range. This yields a number of advantages:

low fluorescence background	covalent binding of functional layer onto the substrate without increasing the autofluorescence of base material
low unspecific binding	combination of reactive functional groups with PolyAn antifouling matrix
optimal density and high accessibility of functional groups	morphology and thickness of functional layer tailored to the desired application
uniform spot morphology	narrow variation of surface properties e.g. contact angle homogeneous distribution of functional groups
topography	tuneable surface hydrophilicity / hydrophobicity (contact angle)

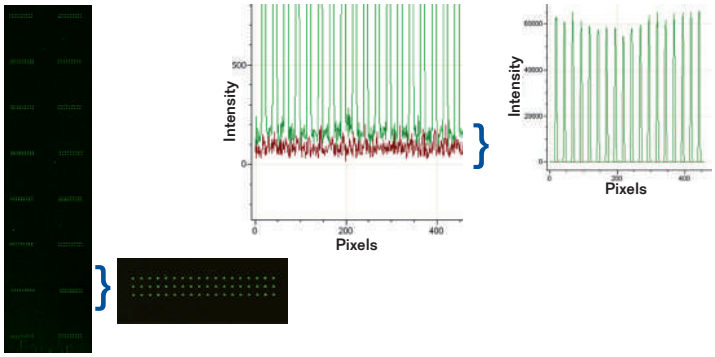


The contact angle is a measure of the wettability (hydrophilicity) of the surface. A narrow specification of the contact angle ensures uniform spot morphology (within a slide and from batch-to-batch) and can also be used as an indicator for the overall homogeneity of a surface.

* Brezensinski, G., Mögel, H.J., Grenzflächen und Kolloide, Spektrum Akad. Verlag, Heidelberg (1993)

Surface Homogeneity

PolyAn's functionalised slides are characterised by a narrow specification of their surface properties, e.g. contact angle and loading, as illustrated in the adjacent figures. The integrated antifouling matrix significantly reduces the background fluorescence of the peptide arrays used in this experiment.



3 x 18 spots TAMRA labelled peptide, immobilized via Lys-sidechain. Readout performed with Axon Genepix 4200AL.*

The image above nicely illustrates the low spot-to-spot variation and excellent spot morphology of PolyAn's reactive 3D-matrix. Additionally, the integrated antifouling matrix ensures a low background outside of the spots resulting in an excellent signal-to-noise ratio.

Excellent Shelf Life

PolyAn's slides are characterised by a long shelf-life when stored dry, at room temperature and protected from sunlight. All slides are packaged in boxes under Argon atmosphere to avoid contamination with particles. The Argon atmosphere also minimises degradation of the reactive surface through contact with air or humidity. Our slides are available in boxes of 5 and 25 slides, respectively.

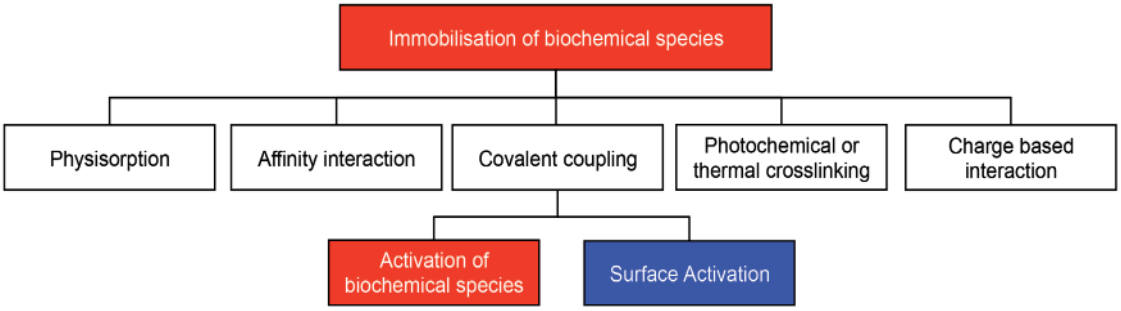
Handling & Buffers

The functionalised substrates should be used in a dust-free environment. Particles on the slide surface may cause defects in the probe binding and cause uneven background.
Unreacted biomolecules and buffer residues must be removed from the slide surface after printing by extensive washing. Additionally, it is necessary to rigorously de-activate remaining free reactive groups on the slide. In order to ensure an optimal performance we advise to use small blocking molecules for de-activating any reactive groups hidden in the 3D-matrix to achieve an optimal performance.
PolyAn also offers a range of **buffers & blocking reagents** that are optimised for our reactive surfaces.
Please do not hesitate to contact us, if you have any questions regarding the handling of our surfaces. As part of our technical service we will be happy to support your work.

* Source: JPT Technologies

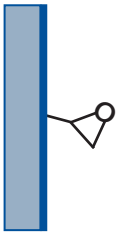
Immobilisation of biochemical Species onto Surfaces

For the immobilisation of biochemical species various coupling techniques and coupling approaches have been developed. PolyAn offers surfaces for nearly all of the methods illustrated below.

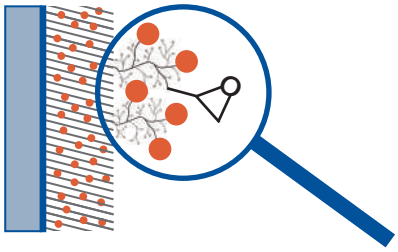


The strongest immobilisation method in biochemistry is the covalent attachment. A covalent bond is formed by sharing of electrons between two atoms. The dissociation energy for a typical covalent bond is 420 kJ/mol and thus far higher compared than the 130 kJ/mol of a typical electrostatic interaction. It can be distinguished between a covalent attachment of activated targets and a covalent attachment of biological species on activated surfaces.

2D- versus 3D-reactive Surfaces



2D-Slide
with functional groups, e.g. Epoxy



3D-Slide with Antifouling Matrix
and functional groups, e.g. Epoxy

- ultra-thin (mono)layer
- rigid structure
- cost-effective reactive surface
- suitable for glass and metal oxides

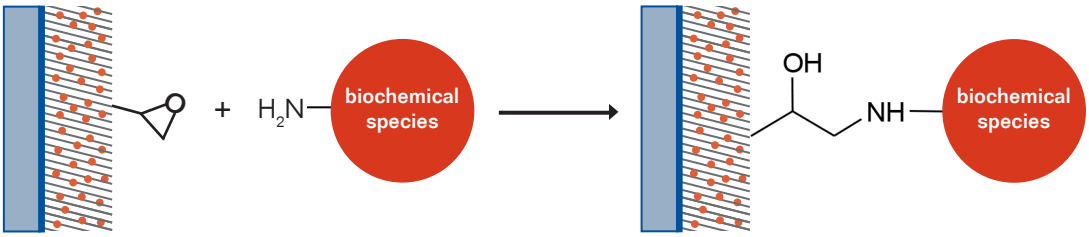
- tentacular, branched polymer structure, partly crosslinked
- thickness: 1 – 50 nm, depending on application
- swellable hydrogel
- for small molecules fully penetratable
- variable density / surface concentration of functional groups

PolyAn Antifouling Matrix

functional groups, e.g. Epoxy

Epoxy Surfaces

for covalent coupling of N-terminal biochemical species

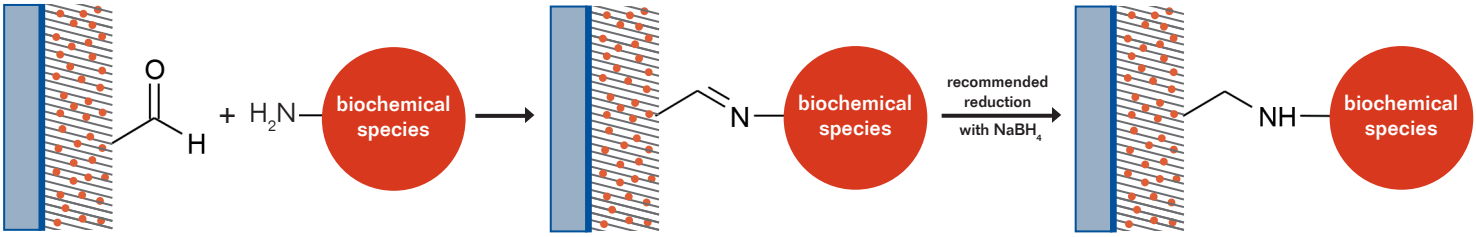


Epoxides are cyclic ethers with a highly strained three member ring. Epoxy rings can be easily reacted with nucleophiles e.g. amines, hydrazines, thiols, hydroxides and carboxyl groups. Compared to NHS esters or 1,4-Phenylene isothiocyates (PDITC) the epoxy surface is more stable and has a longer shelf-life. Epoxy surfaces are stable up to temperatures of 40° C and are also more stable against humidity compared to NHS and PDITC-surfaces.

The nucleophilic addition is catalysed by acid or basic conditions. Under acidic conditions, the oxygen in the ring is positively charged, which facilitates the nucleophilic attack. Under basic conditions the least substituted carbon is attacked by the applied nucleophile in a standard SN_2 reaction.

Aldehyde Surfaces

for covalent coupling of N-terminal biochemical species

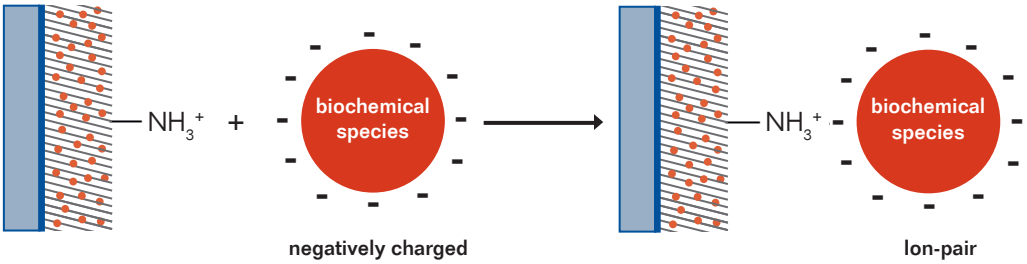


Aldehyde groups react immediately with the NH_2-terminus of biochemical species to form a covalent bond with the surface. In an intermediate state the Aldehydes form an instable Imine-group with the Amines (Schiff-base). Therefore, we recommend reducing the Imines with Sodium Borhydride to form stable Amines.

Upon completion the coupling reaction of other non-reacted aldehydes must be blocked with small molecules that penetrate the 3D-Matrix and effectively quench all remaining reactive groups. If Amines are used for blocking, please again reduce the Imines with Sodium Borhydride to form stable Amines.

Amine Surfaces

for non-covalent coupling of negatively charged biochemical species via electrostatical adsorption

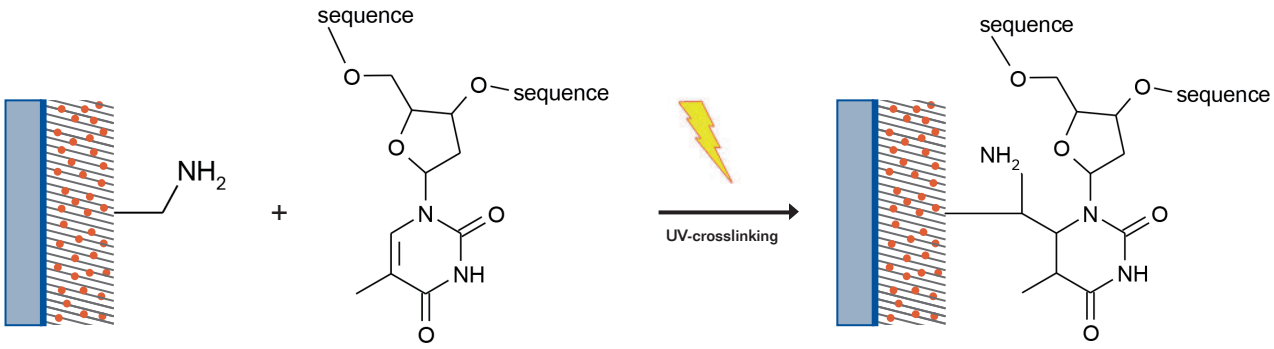


negatively charged

Ion-pair

An adsorptive immobilisation is a non-covalent coupling method on solid supports which is realised by electrostatic, van der Waals interactions, hydrogen bonds and hydrophobic interactions of the reactants, respectively. An electrostatic interaction is formed by an ion-ion-interaction between the surface and the applied biochemical species. The dissociation energy for typical electrostatic bond is 130 kJ/mol. It is about a third of the strength of an average covalent bond. In order to achieve an optimal adhesion the probe buffer and the adhesion conditions (pH-value) have to be optimised.

Binding of Oligonucleotides on Amino Surfaces via UV-Crosslinking



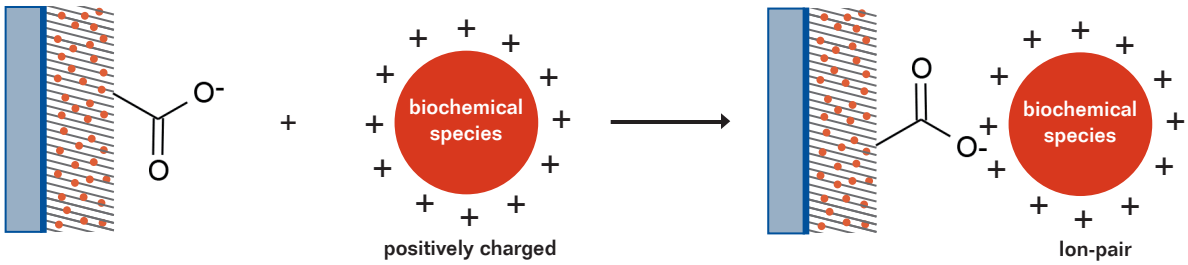
Thymidine

crosslinked Thymidine

The nucleic acid is bound electrostatically on the 3D-Amino surface with its negatively charged backbone or its 5´phosphate group. For immobilisation of nucleic acids we recommend an UV-crosslinking after adsorption to form a covalent bond. During the UV irradiation the base Thymine forms radicals which undergo a H-abstraction in the 3D-Matrix.

Carboxy Surfaces

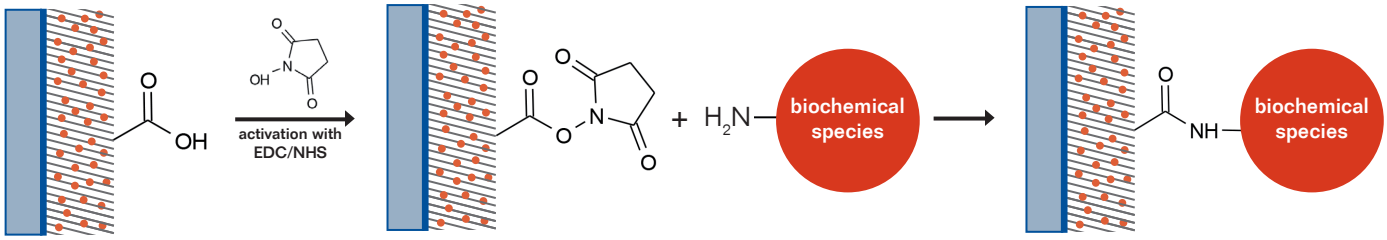
for non-covalent coupling of positively charged biochemical species via electrostatical adsorption



An adsorptive immobilisation is a non-covalent coupling method on solid supports which is realised by electrostatic, Van der Waals interactions, hydrogen bonds and hydrophobic interactions of the reactants, respectively. An electrostatic interaction is formed by an ion-ion-interaction between the surface and the applied biochemical species. The dissociation energy for typical electrostatic bond is 130 kJ/mol. It is about a third of the strength of an average covalent bond. In order to achieve an optimal adhesion the probe buffer and the adhesion conditions (pH-value) have to be optimized.

NHS Surfaces

for covalent coupling of N-terminal biochemical species



The NHS-ester reacts immediately with the NH_2-terminus of biochemical species to form a covalent bond with the surface (420 kJ/mol). The reaction of carboxyl groups with N-Hydroxy succinimide leads to highly reactive esters, which can be easily reacted with nucleophiles e.g. Amines, Hydrazines. However, due to its high reactivity the NHS-ester is susceptible against hydrolysis and is characterised by a relatively short shelf-life. All NHS-activated surfaces should therefore be processed quickly.

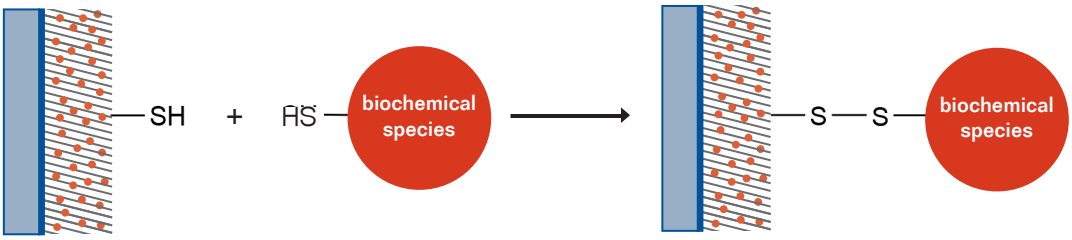
There are a number of different approaches to couple on the NHS surface:

- It is assumed that not all carboxy groups have reacted to NHS esters during activation. Thus a negatively charged carboxy surface still remains which in turn supports the physico-chemical adsorption of positively charged probes e.g. NH_3^+. Hence a protonating media (pH < 5) for the biochemical species getting a positively charge is required.

- A nucleophilic attack on the active ester is also catalysed under basic conditions (pH > 8.5). After attachment of the biochemical species the surfaces must be blocked with a blocking buffer containing small molecules that can access all reactive groups within the 3D-Matrix.

Thiol Surfaces

for an oriented covalent coupling of thiolated biochemical species

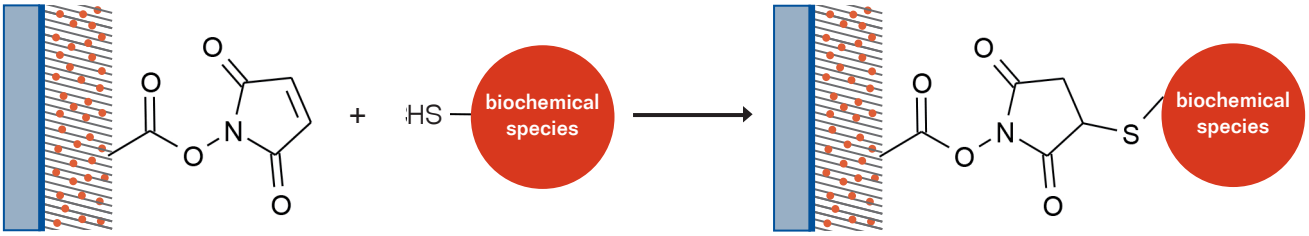


This covalent coupling method is suitable for the oriented or orthogonal coupling of thiol modified probes or biochemical species.

Only thiol groups can be reacted with the double bond of the Maleimide active esters. Similar to a NHS-modfification the esters that are formed are susceptible against hydrolysis. Thiolated probes or biochemical species can contain disulfides bridged dimers and must be reduced e.g. by using Dithiothreitol (DTT) or Cleland´s reagent for an optimal and effective surface coupling.

Maleimide Surfaces

for an oriented covalent coupling of thiolated biochemical species

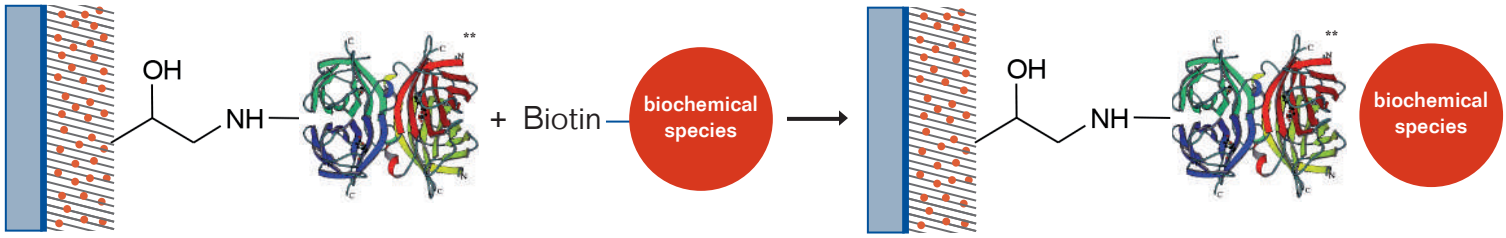


This covalent coupling method is suitable for the oriented or othogonal coupling of thiol modified probes or biochemical species. Only thiol groups can be added on the double bond of the Maleimide active esters. Similar to the NHS-modification the formed esters are susceptible against hydrolysis. Thus, we recommend processing the slides immediately after opening the sealed bags. Thiolated probes or biochemical species containing disulfide bridged dimers must be reduced e. g. with Dithiothreitol (DTT) or Cleland´s reagent, for an optimal and effective surface coupling.

Avidin, Streptavidin and Neutravidin Surfaces

for non-covalent oriented coupling of Biotin modified biochemical species

Avidin is a glycoprotein comprised of four polypeptides that are connected with carbohydrates via glycosidic bonds. Avidin is a tetrameric protein which forms a highly specific binding site for Biotin. Neutravidin is a deglycosylated form of avidin. The Avidin (Streptavidin/Neutravidin) -Biotin-bond is one of the strongest known, non-covalent bond in biology/biochemistry ($K_D = 10^{-15}$ mol/l*). The binding site for Biotin is formed by various amino acids. When using covalently attached Avidin, Streptavidin or Neutravidin the molecules are less susceptible for desorption in the presence of alkaline, acids, in solutions of high ionic strength or at high temperatures. Biotin affine proteins can be distinguished by their isoelectric point, specificity and nonspecific binding as illustrated in the following table.

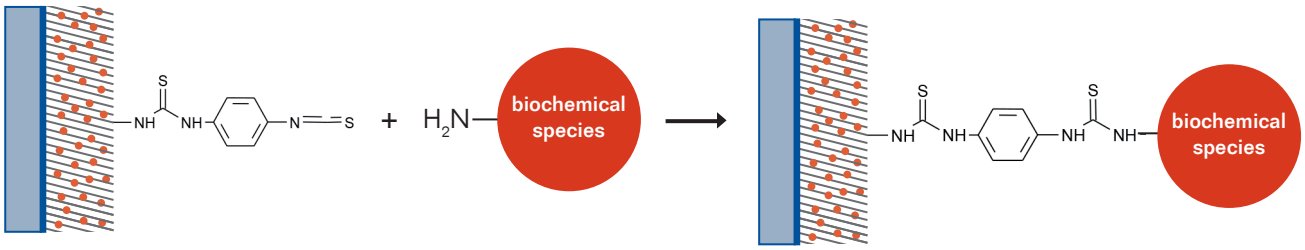


	Avidin	Streptavidin	Neutravidin
Molecular Weight	67 kDa	53 kDa	60 kDa
Biotin-binding Sites	4	4	4
Isoelectric Point (pI)	10	6.8 – 7.5	6.3
Specificity	Low	High	Highest
Affinity for Biotin (K_D)	10^{-15} M	10^{-15} M	10^{-15} M
Nonspecific Binding	High	Low	Lowest

* dissociation rate
** structure of streptavidin from http://relic.bio.anl.gov/relicPeptides.aspx

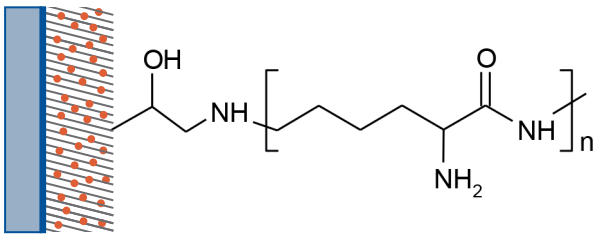
PDITC Surfaces

for covalent coupling of N-terminal biochemical species



The PDITC (1,4- Phenylendiisothiocyanate) is a homobifunctional linker, that immediately reacts with nucleophiles e.g. Amines, Hydrazines, Thiols and Hydroxides to form stable covalent bonds. After attachment of the biochemical species the surfaces must be blocked with a blocking buffer containing small molecules that can access all reactive groups within the 3D-Matrix.

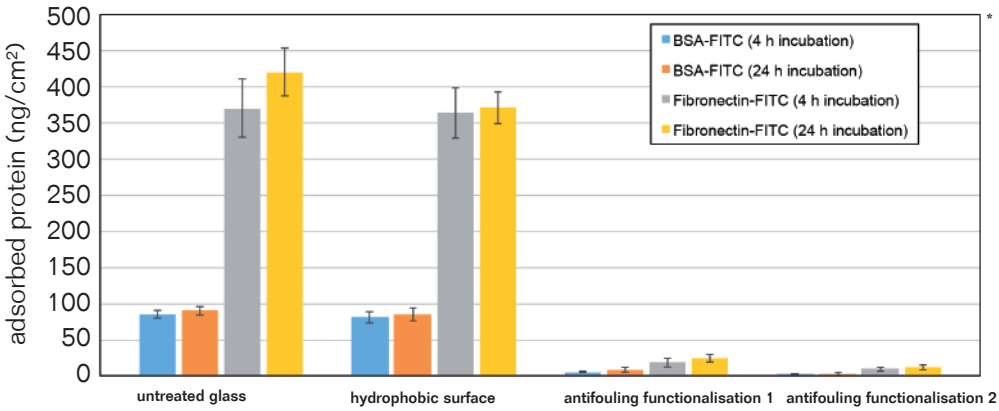
Poly-L-Lysine Surfaces



A higher density of surface amines can be achieved with the Poly-L-Lysin which is covalently attached on 3D-surfaces. Slides covalently coated with Poly-L-Lysine can be used as adhesive microscope slides for the electrostatic coupling of biomolecules or biological samples, e.g. DNA, cells, tissues.

Antifouling Surfaces for Reduction of unspecific Binding

PolyAn offers antifouling coatings for a wide range of plastic consumables. Our proprietary coating reduces biofouling and also cell adsorption on nearly any synthetic surface. Products include cups, 96-well microtiter plates, microfluidic devices and a wide range of customised products.



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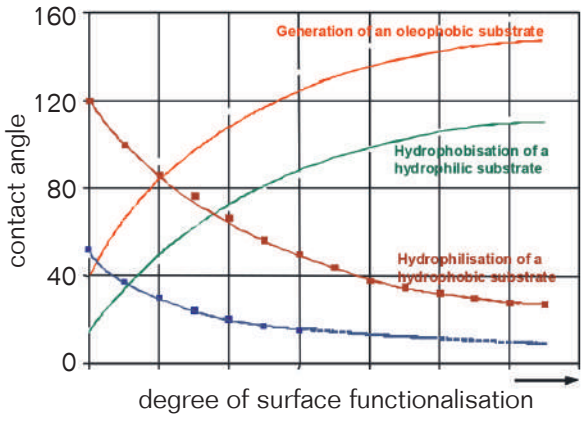
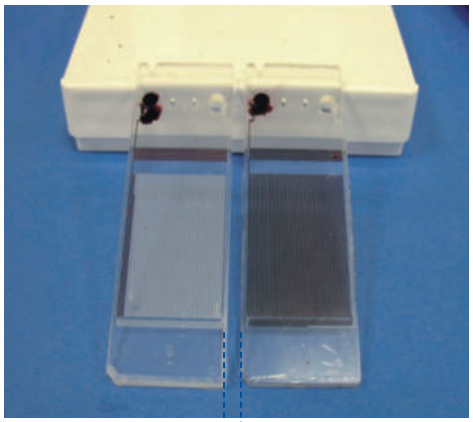
PolyAn's antifouling coating is covalently anchored on the base substrate. The surface modification is permanent. The autofluorescence and mechanical characteristics of the base substrate are not influenced by PolyAn's surface modification.

Increasing Wettability of Microfluidics





Retarded flow velocity of ink in unmodified (hydrophobic) channels

Enhanced flow velocity of ink in permanently hydrophilised channels

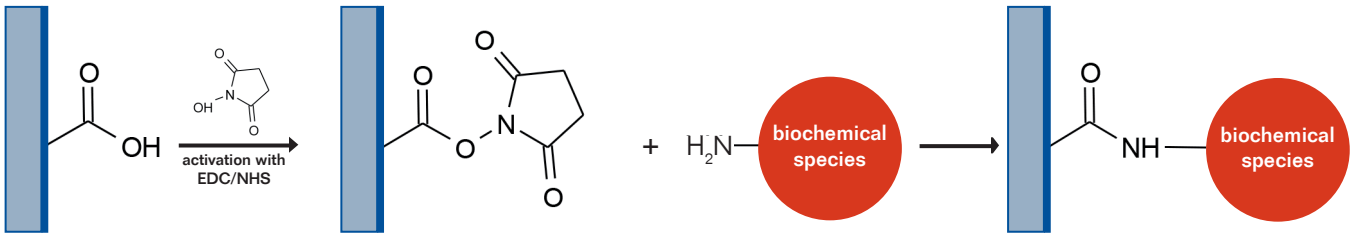
* Data generated in collaboration with FU Berlin

2D reactive Surfaces

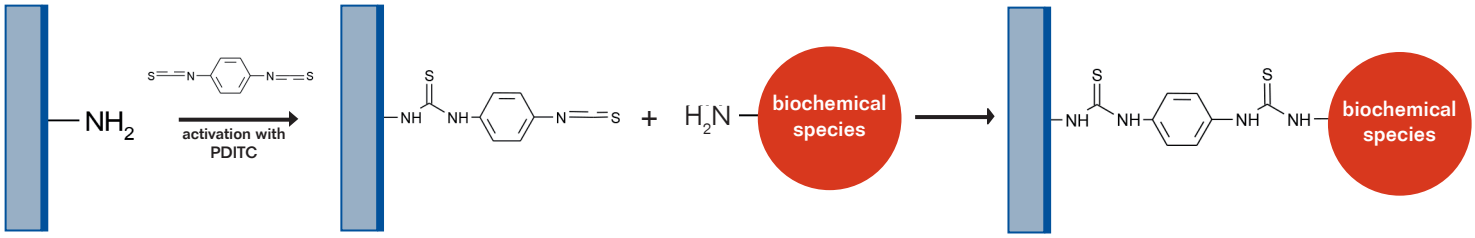
For cost-sensitive applications PolyAn has developed a range of 2D (2-dimensional)-reactive glass slides that are manufactured from high quality glass with an ultra-flat surface and low inherent fluorescence. The glass is coated with a thin silane layer that will covalently bind most types of biomolecules. The defect-free surface features uniform functional layers that provide a high covalent coupling efficiency together with a very low background. The slides are easy to use, and are fully compatible with all commercially available arraying and scanning instruments.

Besides standard glass slides and coverslips, PolyAn also offers the functionalisation of metal and metaloxides, gold and silver substrates. Both, the density of the functional groups and the contact angle can be optimised for your application upon request.

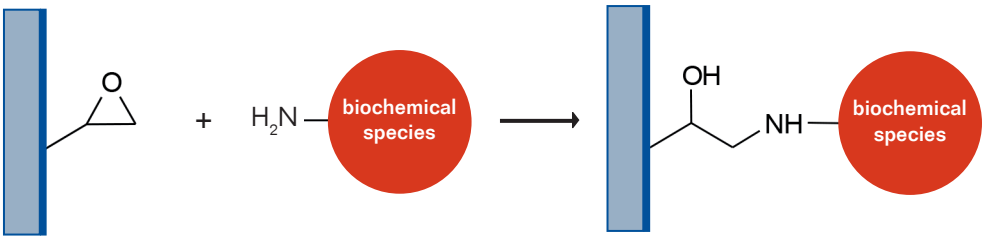
2D-Carboxy **2D-NHS**



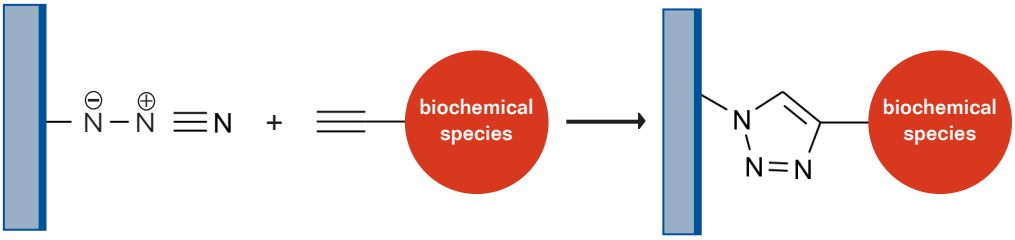
2D-Amine **2D-activated Amino (PDITC)**



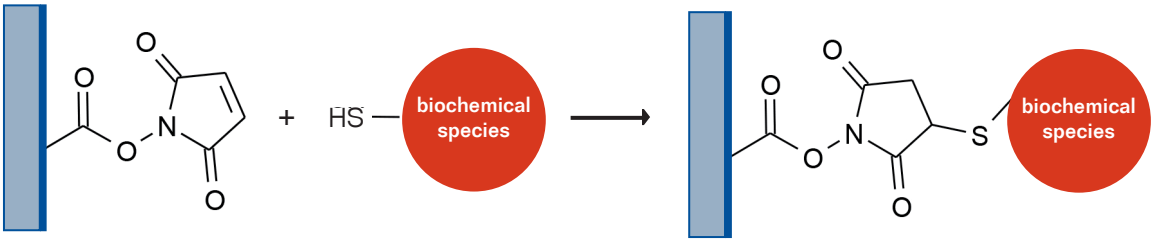
2D-Epoxy



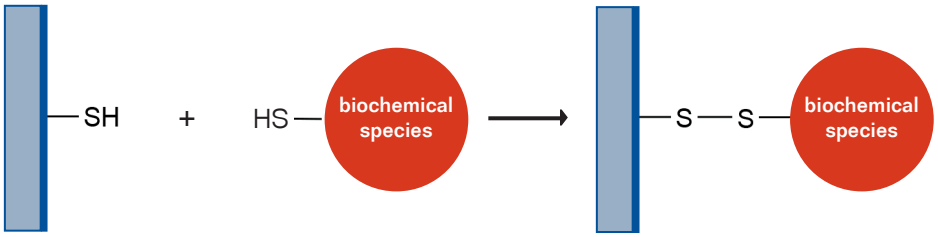
2D-Azide



2D-Maleimide



2D-Thiol



PolyAn silanised Microarray Glass Slides

Surface modification	Product ID
2D-Amino	104 00 021
2D-Epoxy	104 00 221
2D-activated Amino (PDITC)	104 00 421
2D-Thiol	104 00 521
2D-Azide	104 00 621
2D-Carboxy	104 00 121

All glass slides have the standard dimension of 25.0 mm x 75.6 mm with a thickness of 1 mm. Our slides are available in boxes of 5 and 25 slides, respectively. Other functionalities and sizes are available upon request.

PolyAn MSE-functionalised Glass Slides

Surface modification	Product ID
3D-Amino	104 00 001
3D-Epoxy	104 00 201
3D-Aldehyd	104 00 301
3D-Carboxy	104 00 101
3D-NHS	104 00 401
3D-NHS (hydrophilic)	104 00 402
3D-activated Amino (PDITC)	104 01 431
3D-Maleimide	104 02 441
3D-Thiol	104 03 501
Covalently coated Poly-L-Lysin	104 04 201
Covalently coated Streptavidin	104 02 205
Covalently coated Neutravidin	104 03 205
Covalently coated Avidin	104 04 205

All glass slides have the standard dimension of 25 mm x 75.6 mm with a thickness of 1 mm. Our slides are available in boxes of 5 and 25 slides, respectively. Other functionalities and sizes are available upon request.

PolyAn functionalised Coverslips

Surface modification	Product ID
2D-Amino	104 00 026
2D-Epoxy	104 00 226
2D-Thiol	104 00 526
3D-Azid	104 00 626
3D-Epoxy	104 00 012
3D-Carboxy	104 00 106
Streptavidin	104 00 207

All coverslips have the standard dimension of 25 mm x 60 mm. Type #1.5 is used as a standard thickness. All coverslips are packed in boxes of 5.
Other functionalities and formats are available upon request. PolyAn also offers functionalised substrates that are coated with gold or other noble metals as well as waveguide materials.

PolyAn is also the European distributor of **Grace Bio-Labs**. Please do not hesitate to contact us, if you are interested in **Nitrocellulose Film Slides** or the ProPlate™ and FlexWell™ slide handling tools.

PolyAn MSE 3D-functionalised Polymer Slides

Surface modification	Product ID
3D-Amino	104 00 051
3D-Epoxy	104 00 251
3D-Aldehyde	104 00 351
3D-Carboxy	104 00 151
3D-NHS	104 00 451
3D-activated Amino (PDITC)	104 00 481
3D-Maleimide	104 01 441
3D-Thiol	104 00 551
Covalently coated Poly-L-Lysin	104 01 251
Covalently coated Streptavidin	104 02 255
Covalently coated Neutravidin	104 03 255
Covalently coated Avidin	104 04 255

All microarray slides have the standard dimension of 25 x 75 x 1 mm. Our slides are available in boxes of 5 and 25 slides, respectively. Other functionalities and formats are available upon request. PolyAn also offers functionalisation of 100µm and 190µm COP films (Cycloolefin Polymer or Copolymer).

PolyAn functionalised 96-well Plates

Surface modification	Product ID
3D-Epoxy	00 680 251
3D-NHS	00 690 451
Streptavidin	00 697 251
Neutravidin	00 693 251

Standard plates for microarray applications are transparent 12 x 8 strip flat bottom 96-well plates. All functionalised 96-well plates are available in the dimensions 85 x 128 x 14 mm. PolyAn can equip most 96-well plate types with our 3D-reactive matrices. This includes plates comprised of Polystyrene (white or transparent), Polypropylene and COP/COC materials.

PolyAn's multipart plates are comprised of a functionalised glass plate (75 x 110 mm) which is combined with a 96-well superstructure after the printing process. All of the 96-well and 384- well ProPlate designs are available for this product.

To minimise yield loss in printing, PolyAn also offers 8-strip plates. Please do not hesitate to contact us, so that we can offer you a format that is optimally tailored to your application and printing facility.

PolyAn Buffers & Solutions

Buffer / Solution	used for	Ingredients	Product-ID
PolyAn Blocking A	surface passivation of NHS, Epoxy, Aldehyde and PDITC modifications	anionic surfactants, Amines, pH=9.0	000 02 511
PolyAn Blocking B	surface passivation of Streptavidin, Amines, PDITC modifications	proteins, surfactants	000 02 611
Wash solution I + II (suited for DNA microarrays)	for an optimal wetting and reducing of non specific interactions	I. ionic surfactants, salts II. lower concentrated ionic surfactants, salts	000 02 701
Wash solution III (suited for DNA microarrays)	for an optimal wetting and reducing of non specific interactions	lower concentrated salts	000 02 721

How to place an Order

We are looking forward to your telephone orders and technical enquiries at our Customer Service and Technical Service Department Monday-Friday. Office hours for telephone enquiries are 9:00 AM to 6:00 PM (Central European Time).
Please mention billing and shipping addresses, product-ID, quantity, your phone number or e-mail and name.

Contact
Tel.: +49 (0)30 912078-0
Fax: +49 (0)30 912078-11
Email: mail@poly-an.de

Terms & conditions
PolyAn's general terms & conditions apply.

Ordering process
After placing your order you should receive an order acknowledgement via e-mail within 3 business days. When your slides have been shipped, we will notify you via Email to provide you with the shipping information, e.g. tracking number.

Minimum quantity
The slides are packaged in boxes of 5 or 25 slides, which is the minimum quantity. Discounts are available for large order volumes.

Payment terms
The full price is payable within 14 days after the date of the invoice.

Shipping and handling
All prices are Ex-Works PolyAn, Berlin.
The slides will be shipped via FedEx, UPS, TNT, DHL or airmail.

Distributors

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Quality

PolyAn pursues a policy of continued technical excellence to deliver high quality products and services. Our company is dedicated to product consistency and reliability – providing our customers with highly reproducible consumables for their specific applications.
To ensure this PolyAn has successfully implemented the DIN EN ISO 9001 quality management system for all processes. PolyAn's production facilities also include a class 5 cleanroom.

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