Functionalized Microplates

PolyAn

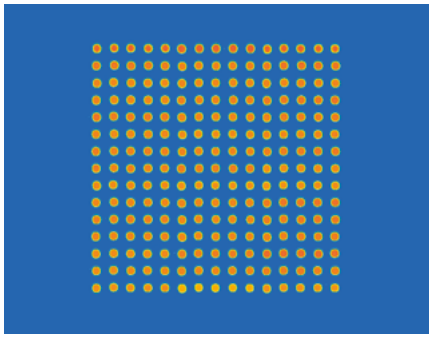
molecular
surface
engineering

www.poly-an.de

About PolyAn

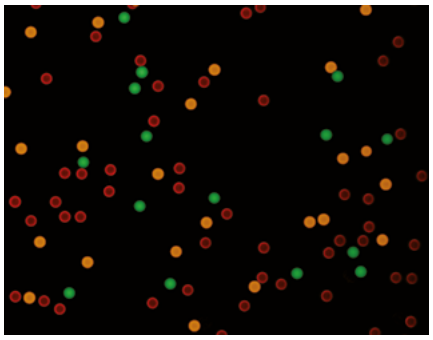
Surface functionalized consumables for LifeScience applications

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



Functionalized Surfaces for Microarrays

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



Fluorescent Micro- and Nanoparticles

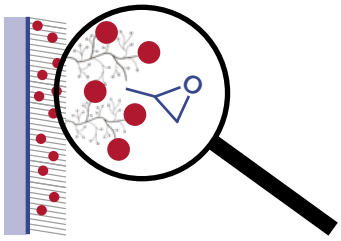
PolyAn is offering a portfolio of monodisperse PMMA micro- and nanoparticles for (bio)applications such as multiplexed bead assays, and for calibration of flow cytometers and fluorescence imaging systems. PolyAn's beads can be color encoded with a wide range of fluorescent dyes and functionalized with PolyAn's reactive 3D-matrices.

Functionalized Microplates

PolyAn's microplates are used for the covalent binding of biomolecules that cannot be immobilized efficiently by passive adsorption. PolyAn offers Amine-binding plates, Click chemistry plates, and Streptavidin-coated plates for demanding assay applications.

Molecular Surface Engineering Services

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



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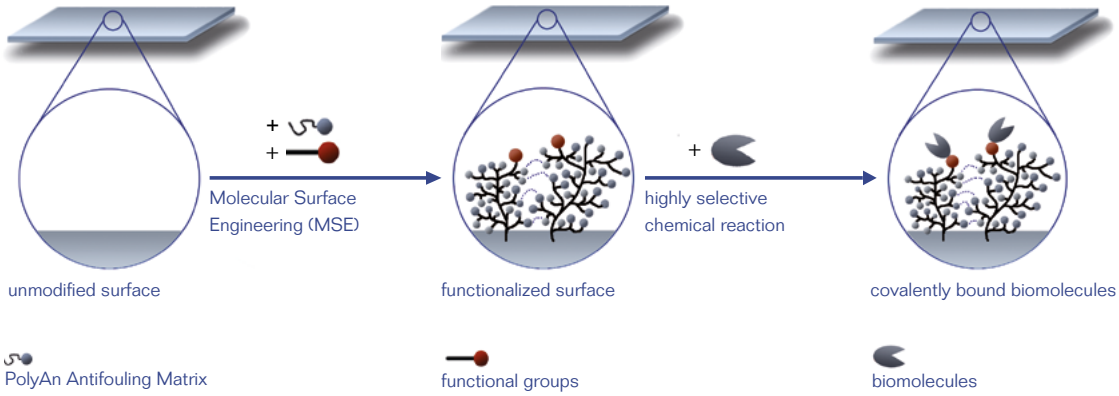
1. Molecular Surface Engineering (MSE)

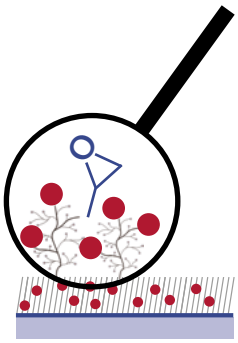
3D-Surfaces for high-performance Applications

PolyAn's Microplates are functionalized with a 3D-Surface chemistry comprised of a long chain polymer containing a homogeneous density of reactive functional groups. The 3D-reactive Surfaces can be applied for the covalent attachment of biomolecules such as proteins, peptides, and oligonucleotides:



Functionalized Microplates for Advanced Bioassays

PolyAn's functionalized Microplates are optimal for immobilizing biomolecules that inefficiently coat by passive adsorption. Select the most suitable combination of surface and assay conditions for your specific assay from our broad range of different reactive groups.



Key features:

— Reactive surfaces for covalent immobilization of biomolecules ensure minimal leaching
— Withstands rigorous washing
— Minimal non-specific binding due to 3D-functional matrix
— Directed (bio-orthogonal) immobilization via click chemistry

Applications include:

— Covalent binding of peptides, glycans, oligonucleotides, aptamers, or small molecules for bioassays
— Immunoassays such as Enzyme linked immunosorbent assays (ELISA) and Fluorescence-based immunoassays (FIA)
— Printing of microarrays into 96-well plates

2. Functionalized Microplates

To take advantage of the existing liquid handling and automation solutions for 96-well standard microplates, PolyAn offers a range of functionalized multiwell products that are equipped with the same reactive surfaces as our glass and polymer slides.

96-Well Microplates

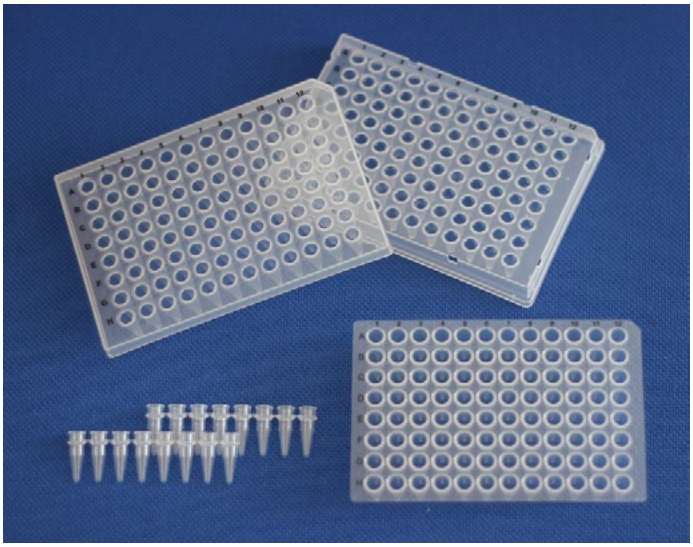
PolyAn offers functionalized 96-well plates with various plate designs, including:

— Standard ELISA plates
— Breakable well plates
— 12 x 8-Well strips and Single-wells
— Polystyrene (PS), Polypropylene (PP), Cyclic olefin copolymer (COP)
— F-bottom, C-bottom, U-bottom, film-bottom …

F-bottom C-bottom U-bottom

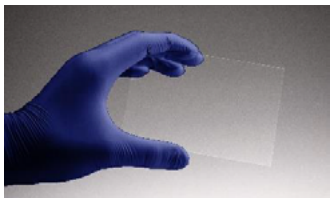
PCR Plates and Strips

PolyAn offers functionalized PCR plates and strips for covalent, bio-orthogonal immobilization of aptamers, oligonucleotides, peptides, and other biomolecules. PolyAn provides plates for PCR-stable, immobilization of biomolecules as well as coating services with custom modification of aptamers, oligonucleotides or peptides. Just provide us the sequence of your choice and we will produce the plates including certificate of analysis.



Glass bottom plates

PolyAn's multipart plates are comprised of a functionalized bottom plate (75 mm x 110 mm) which can be combined with a superstructure after the printing process. This approach increases the printing throughput while minimizing errors due to electrostatic interactions or geometry.



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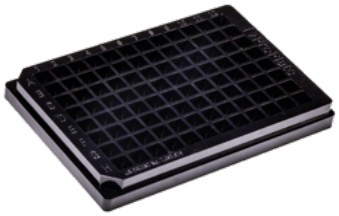


Bottom materials
— Standard 1 mm Glass sheets
— 0.17 mm Coverslips (Type #1.5)
— 1 mm PMMA

Superstructures
— 96-well plate format
— 384-well plate format

Surfaces
All of PolyAn's 2D- and 3D-Surfaces, including reactive groups for:
— Covalent Binding: Epoxy, Aldehyde, NHS, PDITC, Maleimide, Thiol
— Electrostatic Adsorption: Amine, Carboxy, Poly-L-Lysine
— Biotin-Binding: Streptavidin, Neutravidin
— Click Chemistry: Azide, DBCO, MTZ

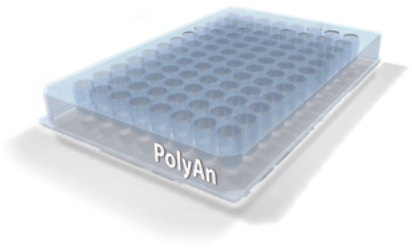
Solvent-stable Polypropylene Plates

PolyAn offers functionalized, solvent-stable microplates that are comprised of polypropylene (PP). Our PP microplates are suitable for applications requiring increased chemical resistance, e.g. liquid storage, compound libraries in drug screening, synthesis, and covalent immobilization of (bio-)molecules.

— Polypropylene provides compatibility with many common organic solvents
— Minimal leaching due to covalent immobilization
— Coating with lower amounts of reagent may be possible
— Reactive surfaces enable control of orientation and directed (bio-orthogonal) binding

Custom Plates and Tubes

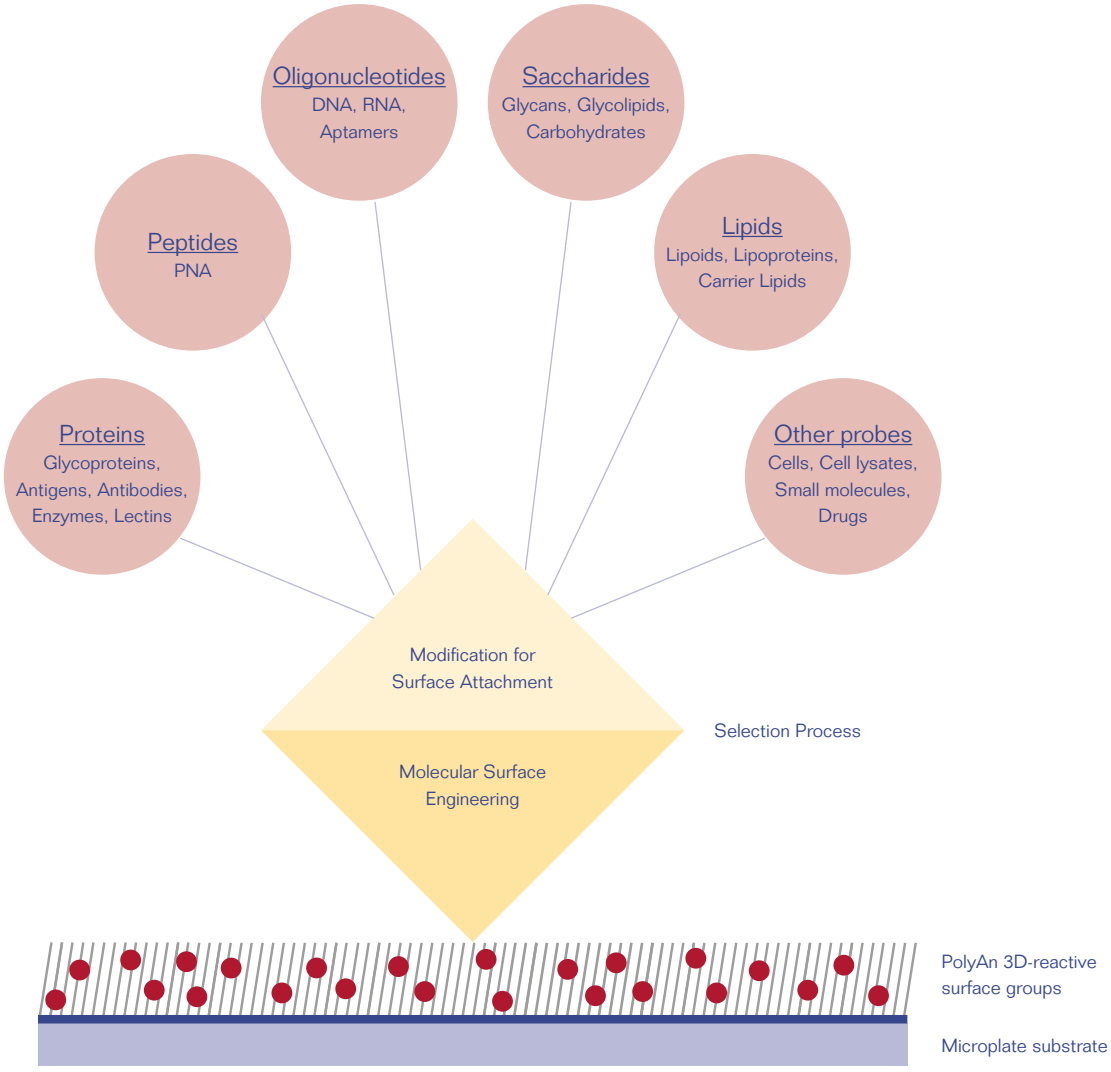
PolyAn also offers functionalization services for custom (plate) formats upon request. Please contact us for assistance in selecting the correct product for your application or to discuss a custom product development.



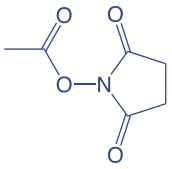
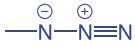
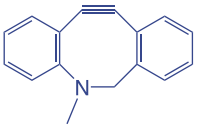
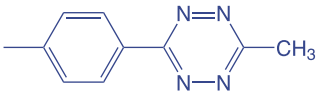
3. Reactive Surfaces for Microplates

Functionalized Microplates for Biomolecule Binding

Selecting the optimal immobilization method for a probe is often an iterative process. For the immobilization of biochemical species various coupling techniques and coupling approaches have been developed. PolyAn offers a very broad portfolio of surfaces and substrates to enable the selection of the optimal surface for each probe and application.



Based on our Molecular Surface Engineering technology PolyAn is offering a range of reactive, functionalized microplates. These surfaces are the ideal platform for the covalent immobilization of biomolecules and allow the selection of the most suitable microplate surface for your specific assay conditions.

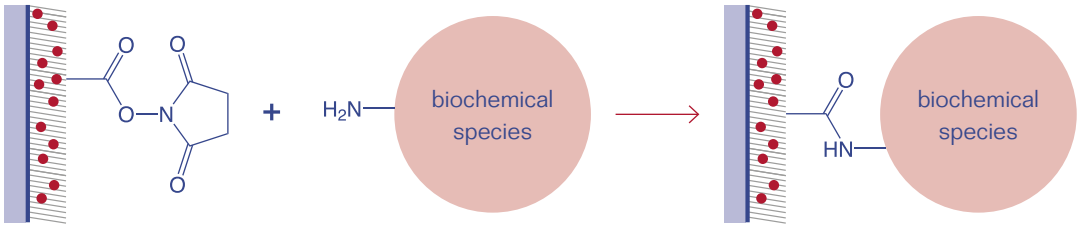
Functional Group	Structure	Application examples
3D-NHS		For direct binding of Amine-containing molecules
3D-Epoxy		For binding of nucleophiles such as Amine-, Thiol-, and Hydroxy-containing molecules
3D-Aldehyde		For reaction with Amine-containing molecules
3D-Azide		For reaction with Alkyne groups and DBCO-modified molecules via Click chemistry
3D-Dibenzocyclooctyne (3D-DBCO)		For binding of Azide-modified molecules via Click chemistry
3D-Methyltetrazine (3D-MTZ)		For fast ligation with TCO-modified molecules
3D-Streptavidin or 3D-Neutravidin		For coupling of Biotin-functionalized molecules
Low Binding Surfaces (Ultra Low Adhesion, Antifouling)		For low cell binding and/or low protein binding
Customer-specific biolabeling		Custom functionalization with Oligonucleotides, Peptides, Proteins/ Antibodies, Biotin …

3.1 Covalent binding Microplates

PolyAn's covalent binding microplates are optimal for immobilizing biomolecules that inefficiently coat by passive adsorption. PolyAn offers reactive surfaces that bind amines and other nucleophilic groups, providing a convenient method to covalently immobilize biomolecules, e.g. proteins, peptides, oligonucleotides, glycans, or other ligands.

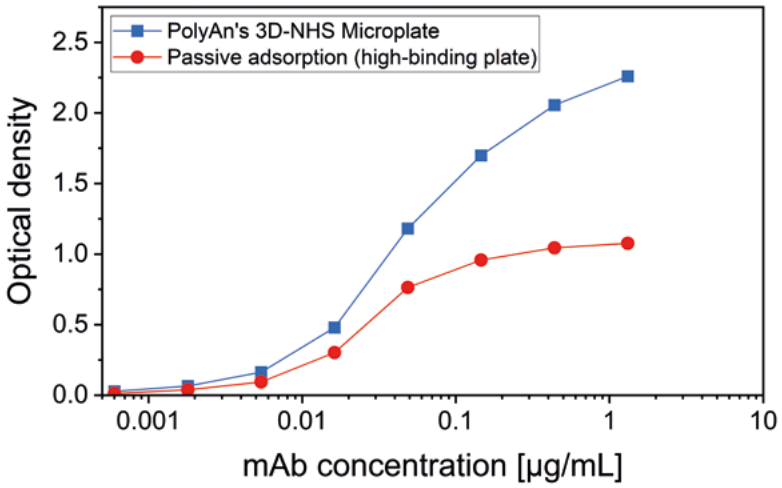
3D-NHS Microplates

provide a highly reactive surface for fast coupling of primary amines.



PolyAn's 3D-NHS Microplates allow a direct and simple approach to covalently attach amine containing molecules to the well surface.

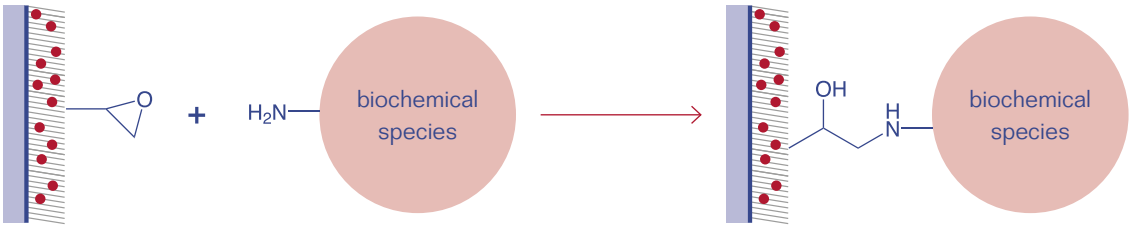
Covalent binding to PolyAn's 3D-NHS Microplates can improve signal intensities and signal-to-noise ratios in enzyme-linked immunosorbent assays (ELISA).
In some applications it is also possible to reduce the required amount of antibodies in comparison to passive (adsorptive) immobilization.



Comparison of the PolyAn 3D-NHS surface with a passive/adsorptive binding surface for ELISA applications: The antigen was immobilized/bound to the surfaces, the corresponding monoclonal antibody (mAb) was added at different concentrations, and the immune complexes were detected using HRP-labelled secondary detection antibodies. The amount of mAb required to obtain an optical density (OD) of 1 is 8x less for the 3D-NHS surface compared to a passive binding surface.

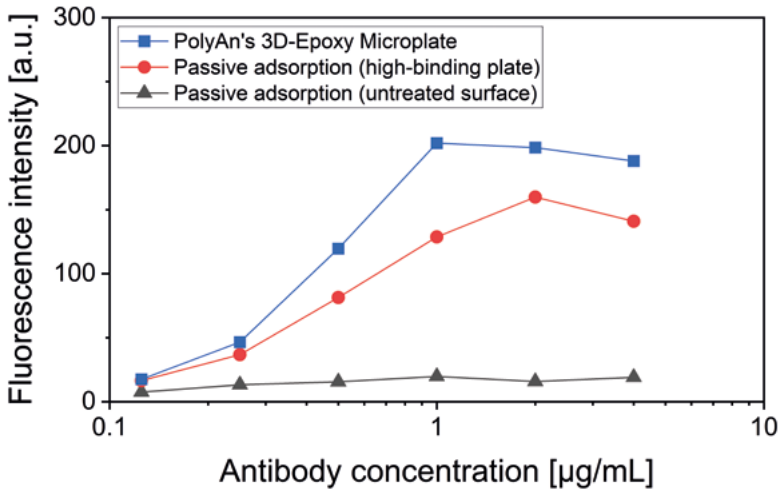
3D-Epoxy Microplates

for covalent immobilization of biomolecules with nucleophilic groups.



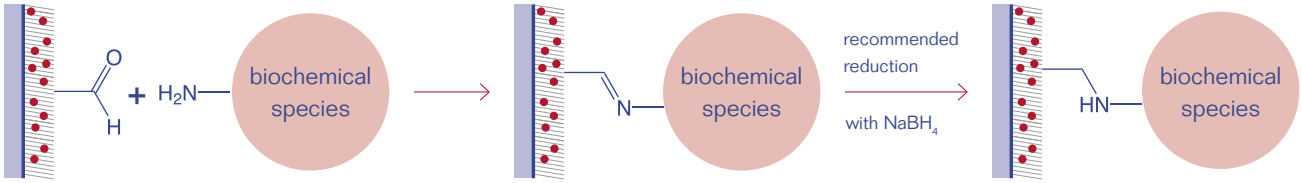
PolyAn's 3D-Epoxy Microplates react with nucleophilic groups, e.g. amines, thiols, or hydroxyl groups, to form a covalent bond. The microplates possess an uncharged surface with integrated low fouling matrix and a long shelf life of up to two years.

Covalent binding to PolyAn 3D-Epoxy Microplates can increase the number of immobilized biomolecules (e.g. antibodies), and thus, the resulting signal intensities in the final bioassay (e.g. in fluorescence-based immunoassays, FIA).



3D-Aldehyde Microplates

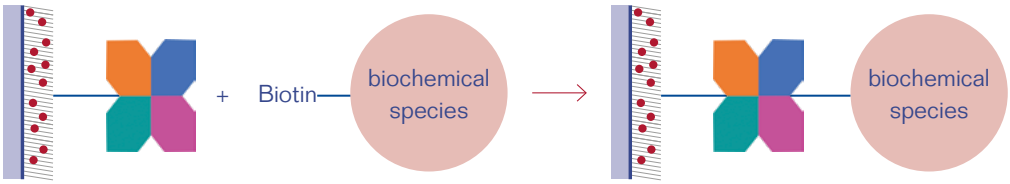
for covalent immobilization of amine-containing biomolecules.



Aldehyde groups bind to amines to form an imine (Schiff-base) as an intermediate. To increase the bond strength it is possible to reduce the imines with e.g. $NaBH_4$ or TCEP (Tris(2-carboxyethyl)phosphine) to form stable secondary amines.

3.2 Streptavidin/Neutravidin coated Microplates

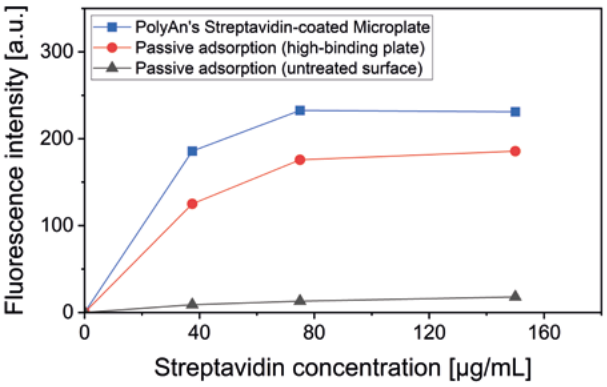
Streptavidin and Neutravidin are tetrameric proteins that can bind four Biotin molecules (vitamin B7) or any other Biotin-conjugated species with a very high specificity. The Streptavidin/Neutravidin-Biotin bond is one of the strongest, non-covalent bonds known in biochemistry, having a dissociation constant of $K_D = 10^{-15}$mol/L Thus, it is often applied in bioanalytical applications



Streptavidin- and Neutravidin-coated plates are made using PolyAn's proprietary Molecular Surface Engineering technology to achieve maximum efficient coating of active Streptavidin or Neutravidin. PolyAn's Streptavidin/Neutravidin coated microplates are suitable for immunoassays as well as DNA hybridization assays.

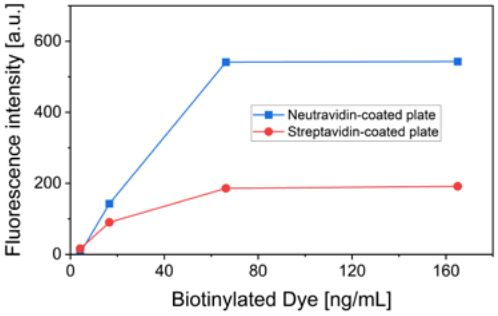
Benefits of covalently bound Streptavidin/Neutravidin

PolyAn's Streptavidin or Neutravidin matrices are covalently attached to the surface, so that the molecules are less susceptible to desorption in the presence of surfactants, solutions of high ionic strength, or at high temperatures, compared to adsorptive immobilization.



Advantages of Neutravidin

Although Streptavidin is still the most popular and widely used biotin-binding protein, Neutravidin offers several benefits:



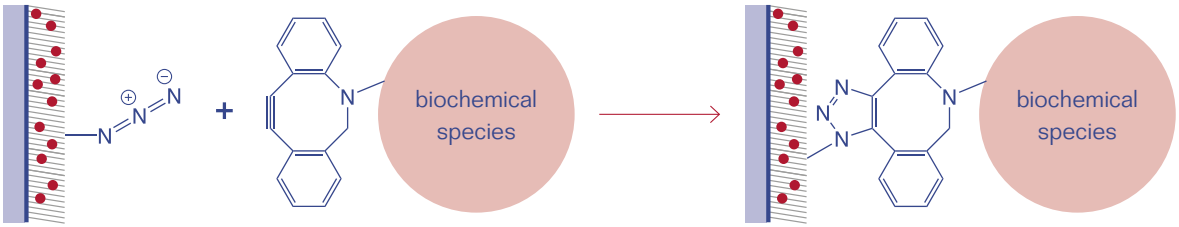
— Near-neutral isoelectric point decreases non-specific interactions
— De-glycosylation prevents non-specific binding of lectins
— Less non-specific binding in cell assays

Its high biotin-binding affinity and low non-specific binding makes Neutravidin the ideal biotin-binding protein!

3.3 Reactive Microplates for Click Chemistry

Click chemistry describes quick and irreversible one pot conjugation reactions that have a high reaction specificity, give a high yield of the desired product, and lead to minimal byproducts. Bio-orthogonal reactions are conjugation reactions that do not interfere with biological processes. PolyAn offers a variety of surfaces that are suitable for bio-orthogonal, oriented conjugation of oligonucleotides, peptides, and other small (bio)molecules via click chemistry.

3D-Azide Microplates

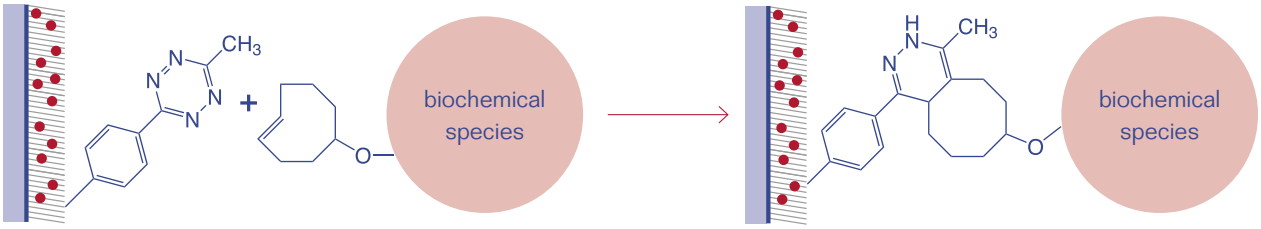


PolyAn's 3D-Azide Microplates can be applied for bio-orthogonal binding of molecules that contain either Alkyne groups in a Copper-catalyzed Alkyne-Azide Cycloaddition, or Dibenzocyclooctyne (DBCO) groups in a Strain-promoted Alkyne-Azide Cycloaddition.

3D-DBCO Microplates

PolyAn's 3D-DBCO (Dibenzocyclooctyne) Microplates can be used to bind Azide-modified molecules via copper-free click chemistry (Strain-promoted Alkyne-Azide Cycloaddition).

3D-MTZ Microplates

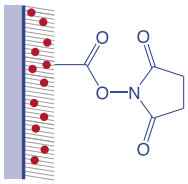


PolyAn's 3D-MTZ (Methyltetrazine) Microplates can be applied for the fast and efficient binding of biomolecules that are modified with a trans-Cyclooctene (TCO) group via an Inverse electron- demand Diels Alder reaction.

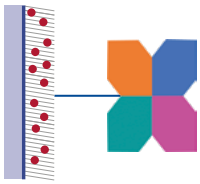
3.4 Comparison of surfaces for oligonucleotide binding

PolyAn's functionalized microplates are particularly suitable for assays that include biomolecules such as oligonucleotides (DNA, RNA, Aptamers) that benefit from oriented coupling and cannot be immobilized efficiently by passive adsorption.

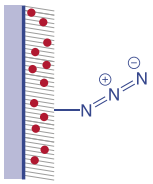
To highlight the advantages and drawbacks of the different surface chemistries offered by PolyAn, we compared some of PolyAn's reactive microplates for a DNA-based hybridization assay.



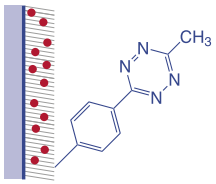
3D-NHS
for Amine-terminated oligos:
Most cost-efficient reactive surface, but low signals due to possible side reactions during immobilization.



Streptavidin/Neutravidin
for biotinylated oligos:
Fast and easy immobilization with best performance at low concentrations, but non-specific binding in complex samples possible.

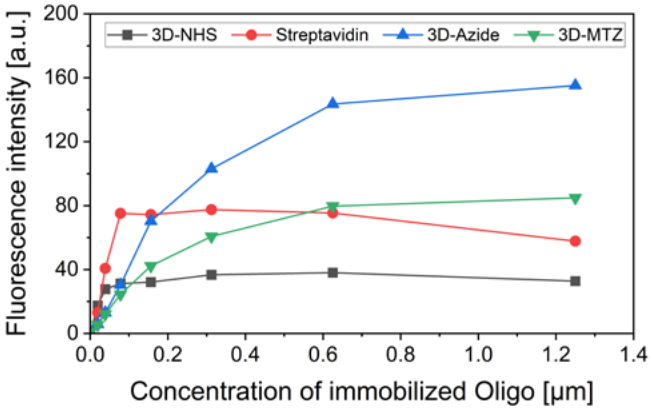


3D-Azide
for Alkyne-/DBCO-modified oligos:
Best performance at higher oligo concentrations, but longer incubation times.

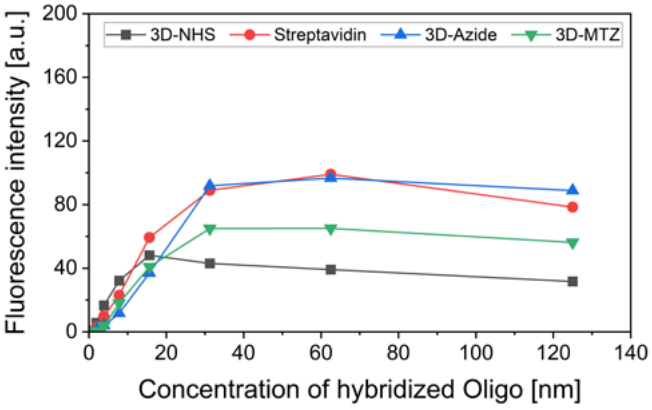


3D-MTZ
for TCO-modified oligos:
Ultra-fast and efficient ligation reaction that can improve the results of hybridization assays.

Variation of oligonucleotide concentration



Variation of anti-strand concentration



A dye-labeled 20mer oligonucleotide strand 5'-modified with either an Amine group, Biotin, DBCO, or TCO was immobilized on PolyAn's 3D-NHS, Streptavidin, 3D-Azide, and 3D-MTZ microplates, respectively. In a second step, a corresponding dye-labeled anti-strand was added. The fluorescence intensities of the dye-labels from the immobilized oligonucleotide strand and the anti-strand were then measured using a fluorescence microplate reader.

When to select a click chemistry approach:

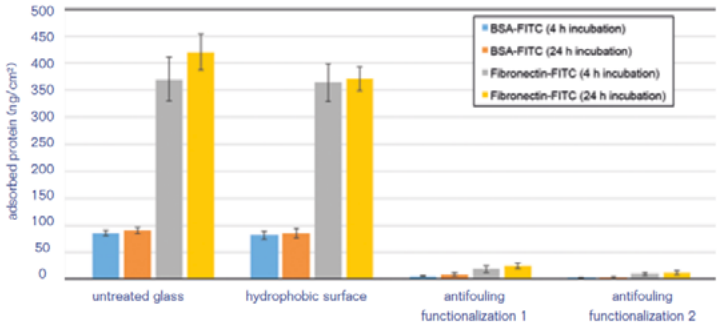
— For applications in which a maximum signal is required
— For applications where non-specific interactions of the Streptavidin-/Neutravidin-Biotin binding may occur
— For applications in which a covalent, bio-orthogonal binding is required, e.g. for PCR or under harsh reaction conditions with organic solvents

4. Low Binding Surfaces

PolyAn offers low binding surfaces for a wide range of consumables, including slides, coverslips, cups, 96-well plates, as well as customized products. Please wdo not hesitate to contact us to discuss your application.

4.1 Low Protein Binding Surfaces (Antifouling Surfaces)

PolyAn's Antifouling surface reduces protein adsorption and biofouling on nearly any synthetic surface. PolyAn's Antifouling coating is covalently anchored on the base substrate, and does not influence the substrate's optical and mechanical characteristics.

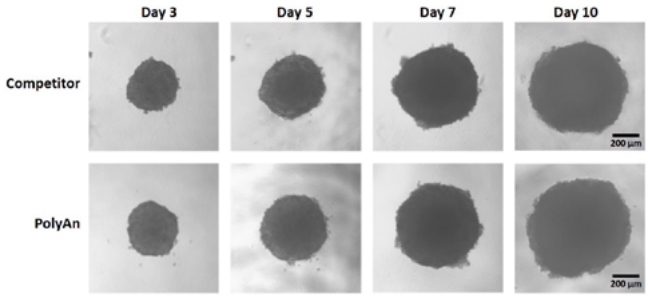


4.2 Low Cell Binding Surfaces (Ultralow Adhesion Surfaces)

PolyAn's low cell binding surfaces are designed to minimize cell adhesion to the surface, and thus, allow reliable cell handling and quantification.

Ultralow Adhesion Microplates (U-bottom)

PolyAn's Ultralow Adhesion (ULA) microplates with U-bottom can be applied for spheroid formation and growth, e.g. in tumor research.



Evaluation of the cytocompatibility and cell-repellent behavior of PolyAn's Ultralow Adhesion microplates using spheroids from the colorectal adenocarcinoma cell line HT-29. Measured at IMTEK (Department of Microsystems, University of Freiburg) in cooperation with Hahn-Schickard.

Cedex® Sample Cups

PolyAn's Cedex Low Fouling Sample Cups are functionalized to reduce non-specific binding of cells on the Cup's walls, and thus, to minimize the potential error when counting cells. Cedex Low Fouling Cups ensure an increased reliability of cell counting systems when using defined media, different cell lines, and variable incubation times.

5. Customer Information

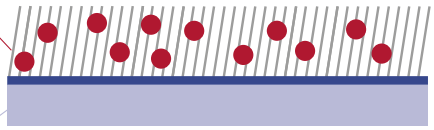
5.1. Custom Microplate Development

Individual Surface Functionalization Solutions
As part of our Molecular Surface Engineering Services, we offer the individual functionalization of substrates for your specific requirements.

Individual solutions

1) Choose your functional surface:

Screen different reactive surfaces to select the optimal matrix for your application

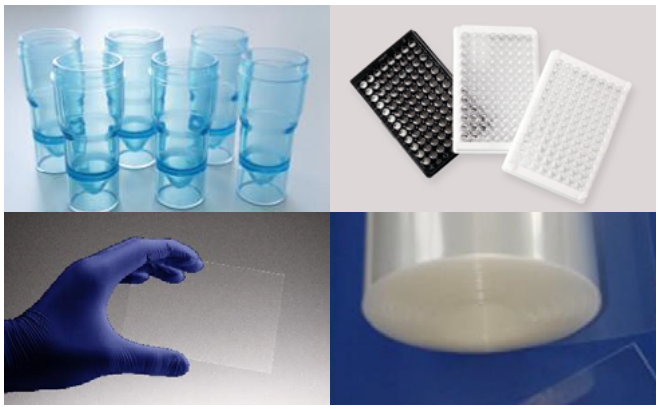


2) Choose your support:

Select the optimal plate format (well shape, material, packaging…) or cartridge design

OR

Bring-your-own plate,...



3) Choose your production scale:

— Transfer from sample size to production scale
— Outsourcing of your production

Custom-made product

Custom product development is the cornerstone capability from which PolyAn's family of products evolved. PolyAn has developed a broad repertoire of manufacturing capabilities that meet customer specifications with regards to tolerances, bio-compatibility, and assay conditions. Our scientists partner with our customers to rapidly build prototypes that enable scaled development and manufacturing.

As a development partner, PolyAn facilitates efficiencies and innovation to maximize your capacities in research and analysis rather than in development and manufacturing. Let us know what you and your company are exploring and we can support you in making that a reality.

5.2 Ordering Information

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 5:00 PM (Central European Time).

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Schkopauer Ring 6
12681 Berlin
Germany

Tel +49 30 912 078 0
Fax +49 30 912 078 11
Email mail@poly-an.de
www.poly-an.de

Ordering Process

After placing your order you should receive an order acknowledgment via e-mail within 1–3 business days. When your products have been shipped, we will notify you via e-mail to provide you with the shipping information, e.g. tracking number.

Shipping and Handling

All prices are Ex-Works PolyAn, Berlin. The products can be shipped via FedEx, UPS, DHL Express or airmail. Please provide your account number, if available.

5.3 International Distributors

Canada, Mexico, USA	AutoMate Scientific, Inc. Tel: +1 510 845 6283 Email: info@autom8.com axiVEND (Microarray specialist) Tel: +1 833 294 8363 Email: info@axivend.com	Japan	Filgen, Inc. Tel: +81 52 624 4388 Email: support@filgen.jp Waki Company Japan Co., Ltd. Tel: +813 5876 4033 Email: sales@waki-bg.jp
China	APG Bio, LTD Tel: +86 21 545 835 65 Email: info@apgbio.com	Korea	Kyongshin Scientific Co., Ltd. Tel: +82 2 576 6303 Email: kss@kyongshin.co.kr
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