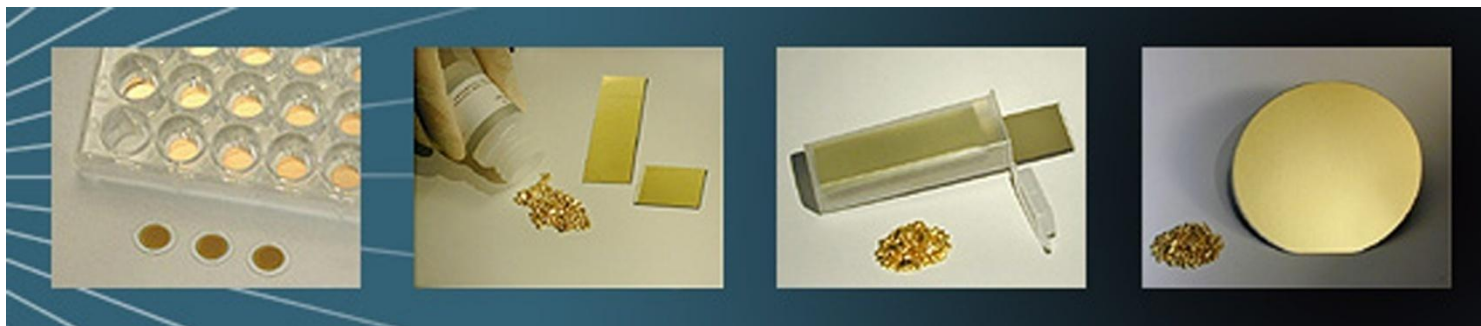


PLATYPUS

TECHNOLOGIES

Bringing Science to the Surface™

Platypus® Gold Coated Substrates



Overview

Gold Coated Substrates

- Gold Coating Introduction
- Glossary of Terms
- Gold Coating Methods
- Critical Features

Platypus® Gold Coated Substrates

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Gold Coating Introduction

What is a gold coating?

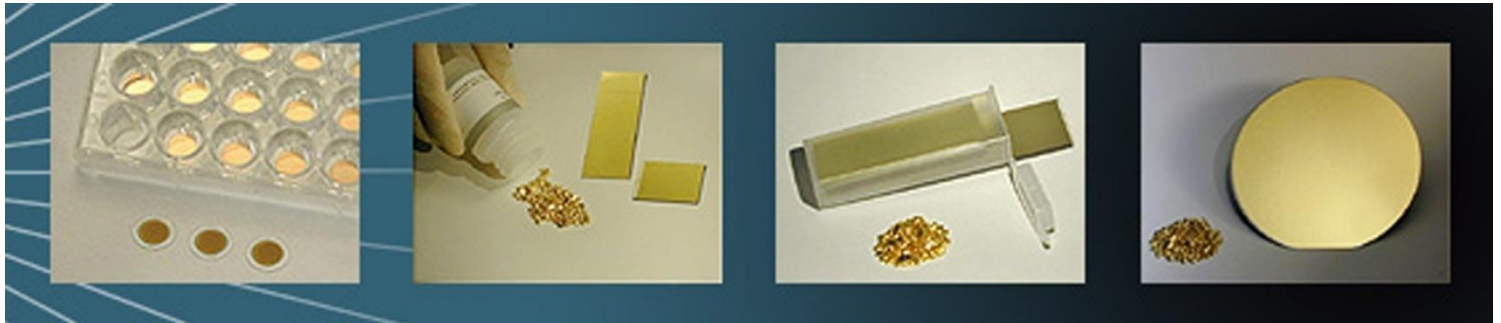
- A very thin film of gold is deposited onto a supporting substrate.

Why is it performed?

- Serves as a very useful substrate in the life science academia & industry markets.

Characteristics of gold surfaces:

- Good resistance to oxidation
- Inert surface for use with biological experimentation
- Good conductor of electricity
- Ultra smooth surfaces can be prepared
- Easily forms thiol chemistry self-assembled monolayers (SAM)



Glossary of Terms

Nanometer (nm):

1×10^{-9} m

Ångström (Å):

0.1 nm

E-beam Evaporation:

A physical vapor deposition technique used for thin film coatings.

Adhesion Layer:

A thin layer deposited for improving the adhesion of gold on to the substrate (material to be coated).

Roughness:

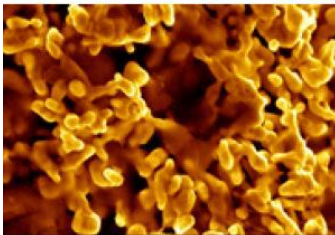
A measure of surface smoothness.

Grain Size:

The size of gold grains present on the surface. Grain size has an effect on the roughness of the gold surface.

Self Assembled Monolayers (SAMs):

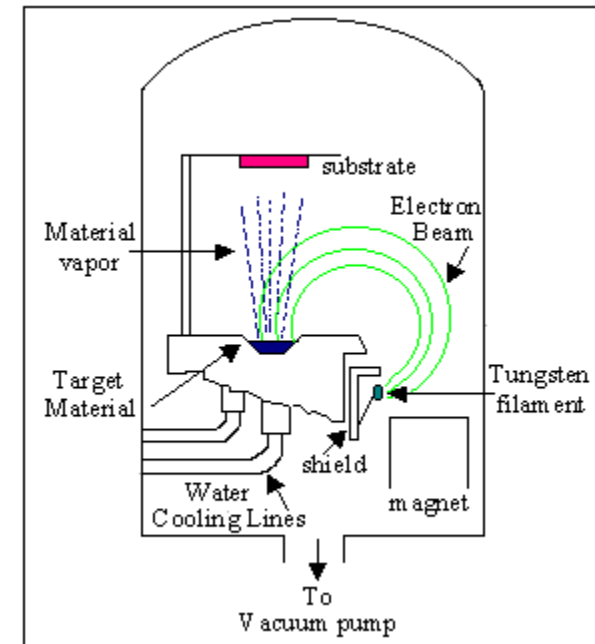
Surfaces consisting of a single layer of molecules on a substrate, prepared by adding a solution of the desired molecule onto the substrate surface and washing off the excess.



Gold Coating Methods

Physical vapor deposition (PVD) techniques are commonly used for depositing metal thin films onto a surface.

- **Thermal vapor deposition:** The material to be deposited is evaporated by electrical resistive heating at low pressure and is condensed onto the substrates.
- **Sputtering:** The material to be deposited is ejected from a source by plasma discharge which is then deposited onto the substrates.
- **Electron-beam vapor deposition:** The material to be deposited is heated to a high vapor pressure by electron beam bombardment in an ultra-high vacuum and is condensed onto the substrates.



Critical Features

Adhesion layer: A thin layer of metal (15-50 Å of titanium or chromium) that is deposited onto the substrate to improve adhesion of the gold layer.

Thickness of gold layer: For most applications a 100-1000Å thick gold thin film is deposited on substrates. Thickness of gold is an important parameter in applications that use different optical techniques.

Roughness: A root mean square (RMS) roughness $< 40\text{Å}$ is desired for most applications. However, for certain scanning probe applications a lower roughness is required.

Surface purity: A clean surface is required for applications that employ gold surface modifications. Depending on the PVD process used, level of vacuum in the system, original purity of the gold source, and history of metals used in the particular system the level of gold thin film purity can vary greatly.

Highlights of Platypus® Gold Substrates

Ultra Clean Substrates – Substrates are cleaned by oxygen plasma prior to coating to promote adhesion and cleanliness.

Dedicated E-beam Coater – Platypus uses an electron beam evaporator dedicated to the deposition of titanium and gold to ensure that the gold thin films on the substrates are as pure as possible.

Cleanroom Facility – The gold coatings are applied in a class 10,000 cleanroom to reduce particulate contamination of the substrates.

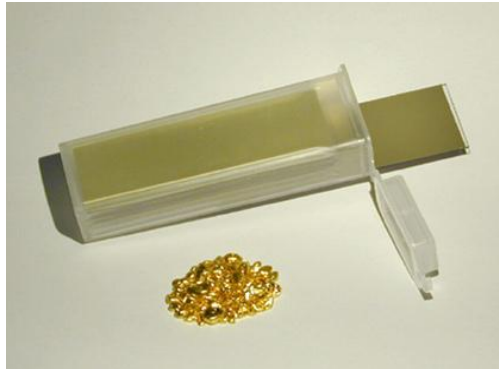
High Reproducibility – Dedicated gold coating equipment, a 99.999% pure gold source, calibrated deposition control, and consistent quality control measurements all contribute to the high reproducibility of Platypus' gold coated substrates.

Titanium Adhesion Layer – Titanium is a better adhesion layer than Chromium; Chromium is able to diffuse into the gold layer faster and contaminate it.

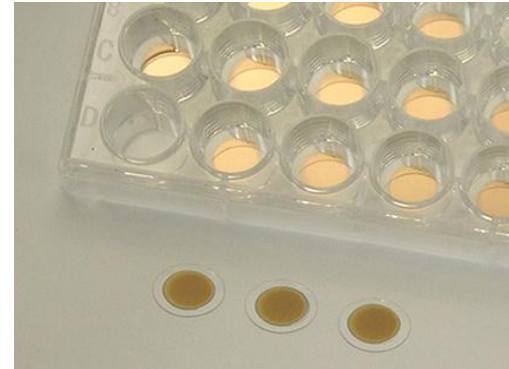
Low RMS Roughness – Roughness of Platypus' gold coated substrates will depend on the thickness of gold and type of substrate it is on, but generally the RMS roughness is between 1.5 and 4nm.

Custom Coatings – Platypus can work with customers to coat custom substrates and/or specified titanium and gold thicknesses.

Platypus[®] Gold Coated Substrates



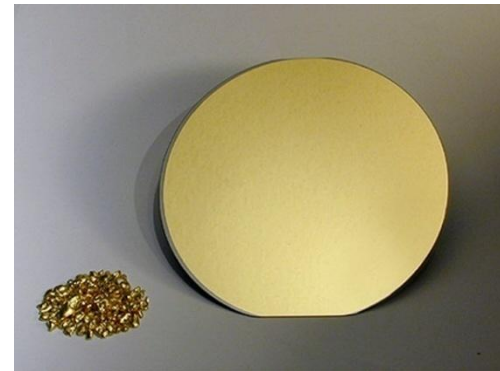
Gold Coated Microscope Slides



Gold Coated Round Coverslips



Gold Coated Square Coverslips



Gold Coated Silicon Wafers

Platypus[®] Gold Substrates

Product #	Product Description	Package Size
AU.0100.ALSI	Aluminosilicate Glass Slides Coated with 20Å Ti/100Å Au 1" x 3" x 0.7 mm	5 slides
AU.0500.ALSI	Aluminosilicate Glass Slides Coated with 25Å Ti/500Å Au 1" x 3" x 0.7 mm	5 slides
AU.1000.ALSI	Aluminosilicate Glass Slides Coated with 50Å Ti/1000Å Au 1" x 3" x 0.7 mm	5 slides
AU.0100.CSS	Coverslips Coated with 20Å Ti/100Å Au 22 mm square, 0.13 to 0.16 mm thickness	12 coverslips
AU.0500.CSS	Coverslips Coated with 25Å Ti/500Å Au 22 mm square, 0.13 to 0.16 mm thickness	12 coverslips
AU.0100.CSR	Coverslips Coated with 20Å Ti/100Å Au 15 mm round, 0.13 to 0.16 mm thickness	24 coverslips
AU.2000.MC1	Mica Coated with 2000Å Au (small); 1" x 1.5" mica	1 piece
AU.2000.MC2	Mica Coated with 2000Å Au (large); 1" x 3" mica	1 piece
AU.1000.SL1	Silicon Wafers Coated with 50Å Ti/1000Å Au 4" diameter, 525 um thickness	3 wafers
AU.1000.SL2	Silicon Wafers Coated with 50Å Ti/1000Å Au 4" diameter, 525 um thickness	12 wafers

Custom Platypus® Gold Substrates

Platypus can work with customers to coat custom substrates and/or specified titanium and gold thicknesses for their particular application.*

Custom Coating Features	Platypus' Capabilities
Substrate Dimensions	Minimum Size = 1cm x 1cm square Maximum Size = 6.5" x 6.5" square
Substrate Thickness	0.1mm - 3 mm
Substrate Type	A vacuum-compatible material (to 10^{-7} Torr)
Thickness of Gold Coating	Minimum = 0 Angstroms Maximum = 3000 Angstroms Note: less than 75 Angstroms of Au may not give a continuous coating and is therefore, not recommended.
Thickness of Titanium Coating	Minimum = 0 Angstroms Maximum = 500 Angstroms Note: 15 - 50 Angstroms of Ti is recommended for an adhesion layer between the substrate and the Au layer. Note: If solely coating Titanium, less than 75 Angstroms may not give a continuous coating and is therefore, not recommended.
Photolithography Patterning	Available for greater than 300 μm features Note: Please contact Platypus with your exact application to evaluate our capability to perform to your specifications.

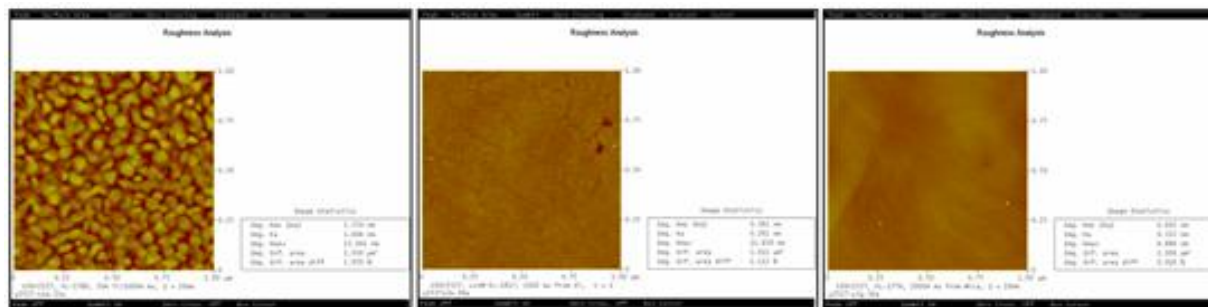
* Platypus also has the ability to make high quality SPR chips based on individual customer requirements.

Platypus® Template Stripped Gold Chips

Platypus® Template Stripped Gold Chips provide an extremely smooth and clean gold surface for a variety of research needs, including AFM and SEM applications, biosensor development, and SAMs studies.*

AFM Characterization

Representative data of RMS roughness over a randomly selected 1 μm^2 area on gold surfaces.



1 μm^2 AFM scan of as-deposited gold on Silicon Wafer
RMS roughness = 17.3 Å

1 μm^2 AFM scan of Platypus® Template Stripped Gold – Silicon Wafer
RMS roughness = 3.6 Å

1 μm^2 AFM scan of Platypus® Template Stripped Gold – Mica
RMS roughness = 4 Å

Goniometer Characterization

Representative data of water static contact angle on gold surfaces.

Surface Condition	Static Contact Angle
As-Deposited Gold (fresh)	25 - 40°
As-Deposited Gold (after exposure to atmosphere for 5 hours)	75 - 90°
Template Stripped Gold Chip (stripped prior to reading)	25 - 40°

Note: All measurements carried out at ambient temperature.

* Please visit <http://www.platypustech.com/templatestrippedgold.html> for more info.

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