



Importance of Microscope Slides and Coverglass in the Laboratory

Presented by:

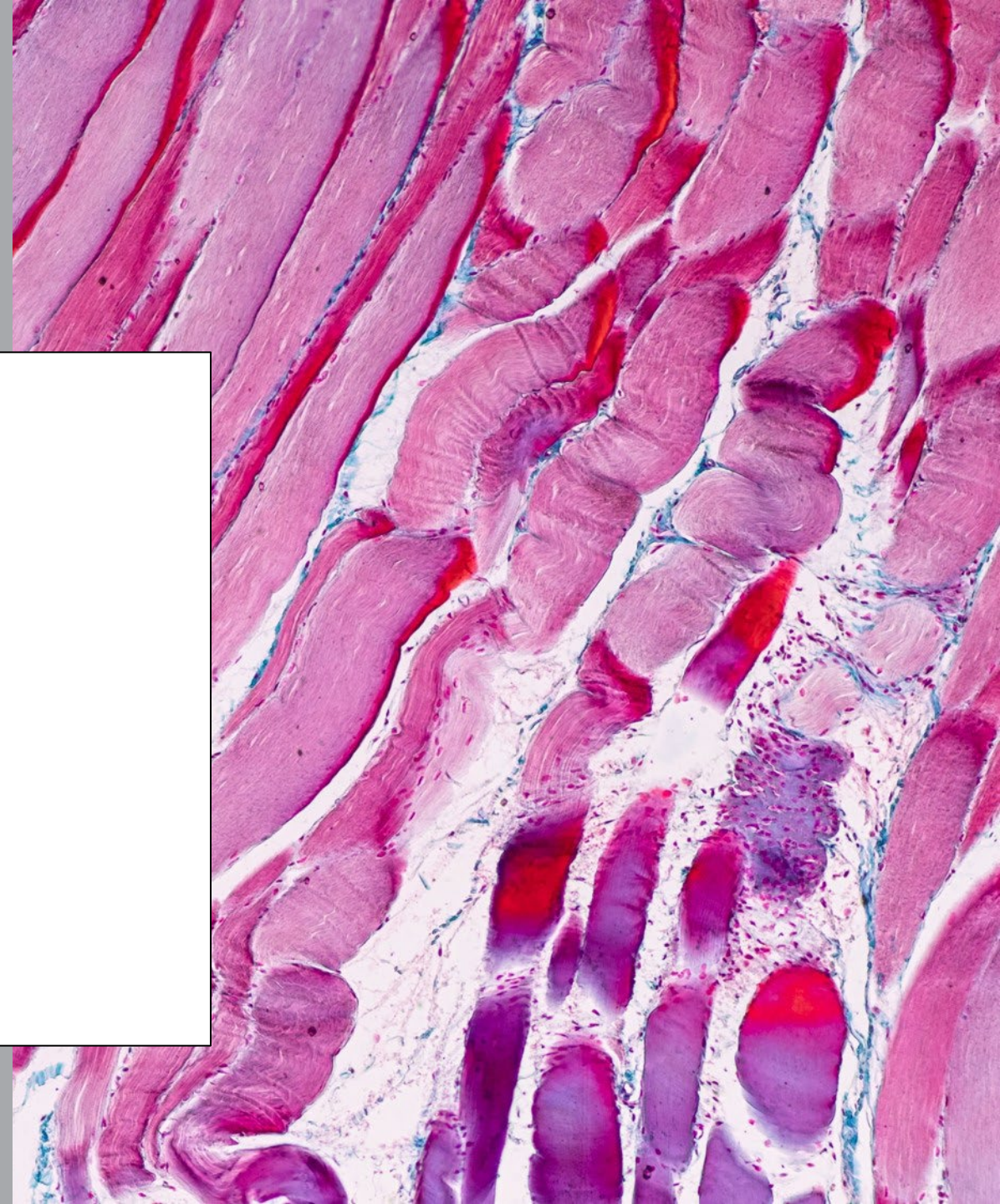
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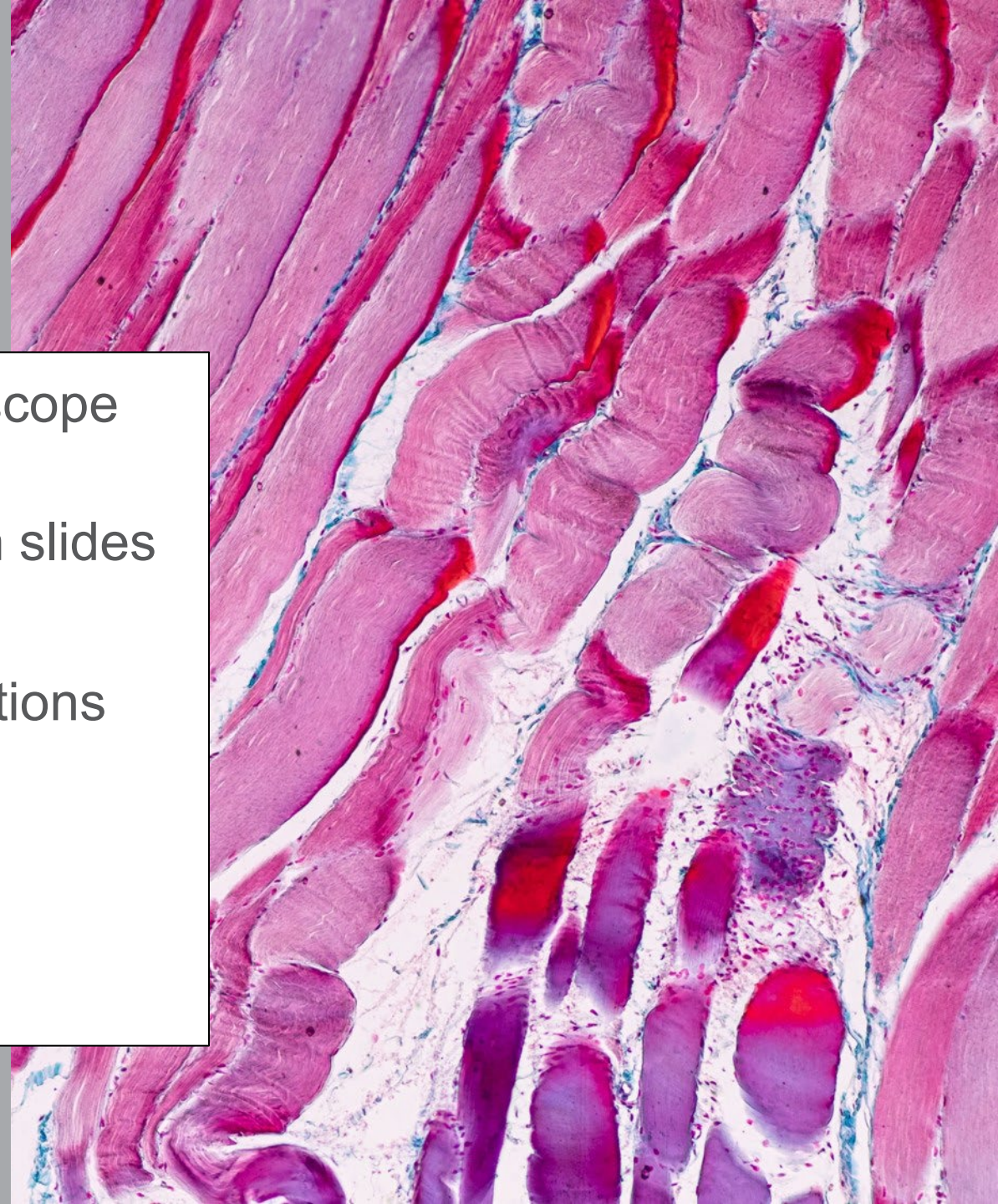
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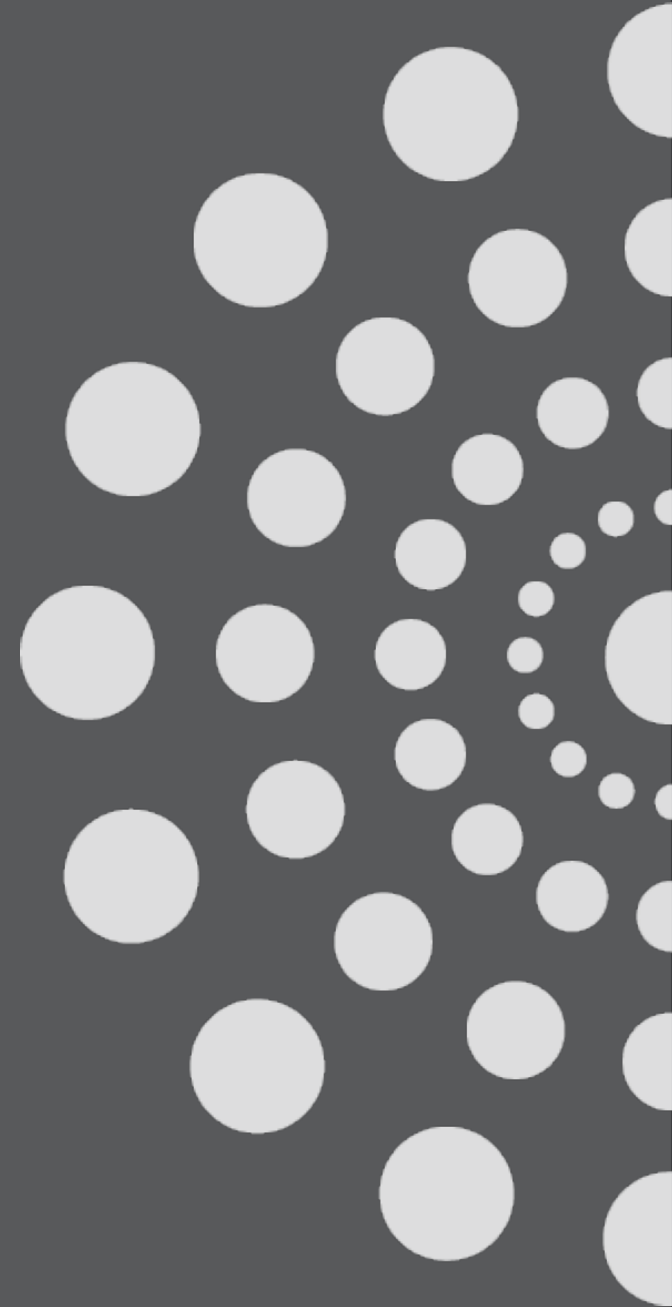


Learning Objectives

- Explain glass manufacturing process
- Microscope Slides
- Identify what makes adhesion properties on slides
- Assess utility of different types of slides
- Discuss importance of coverglass specifications



Glass Slides in the Laboratory



Glassmaking

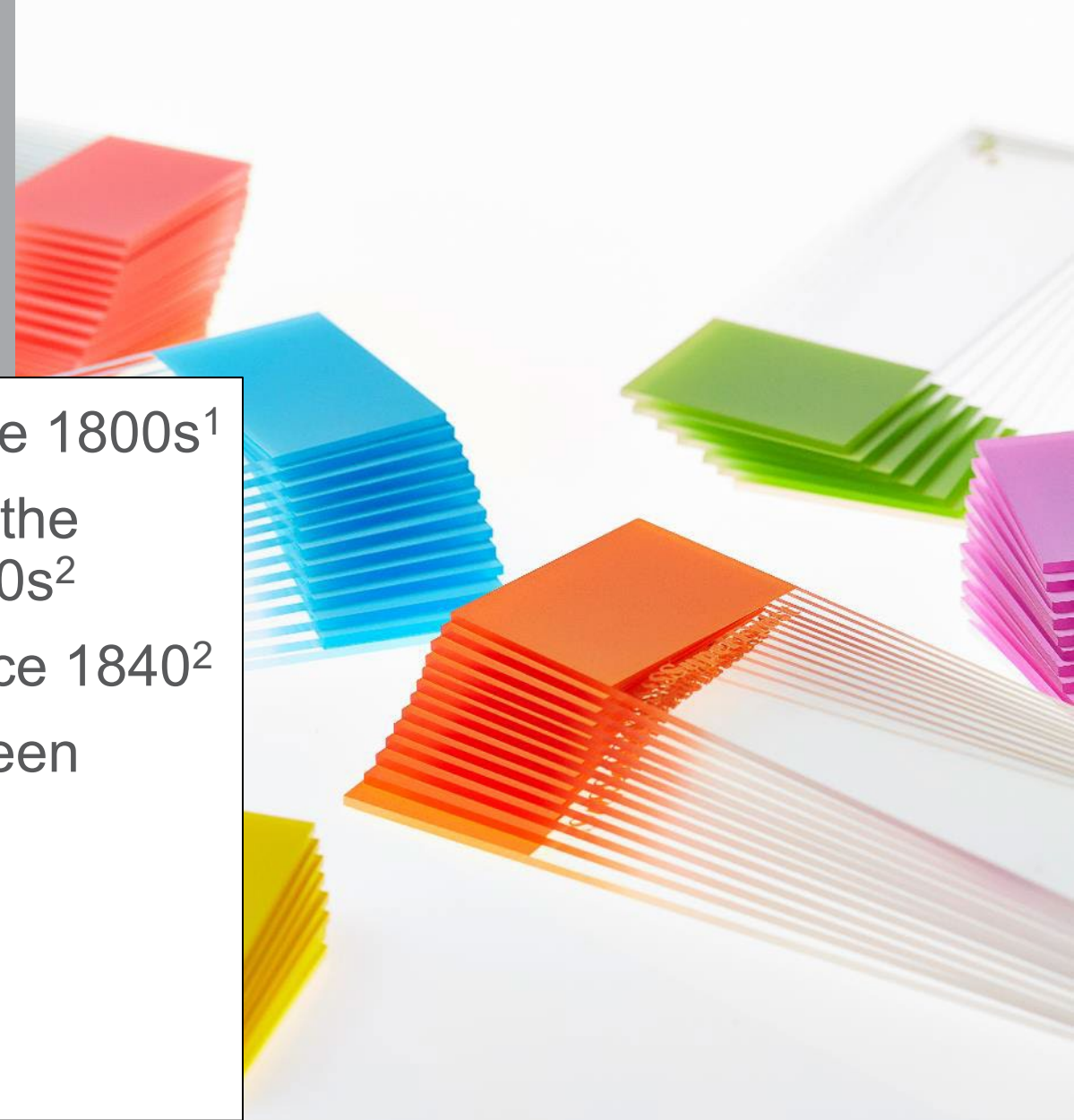
- Glass is thought to have originated in the late Bronze Age, around 1500 BCE¹
- Unlike today, glass was often opaque and saturated with color¹
- The majority of today's glass is soda-lime glass²



Historical Context

Microscope Slides

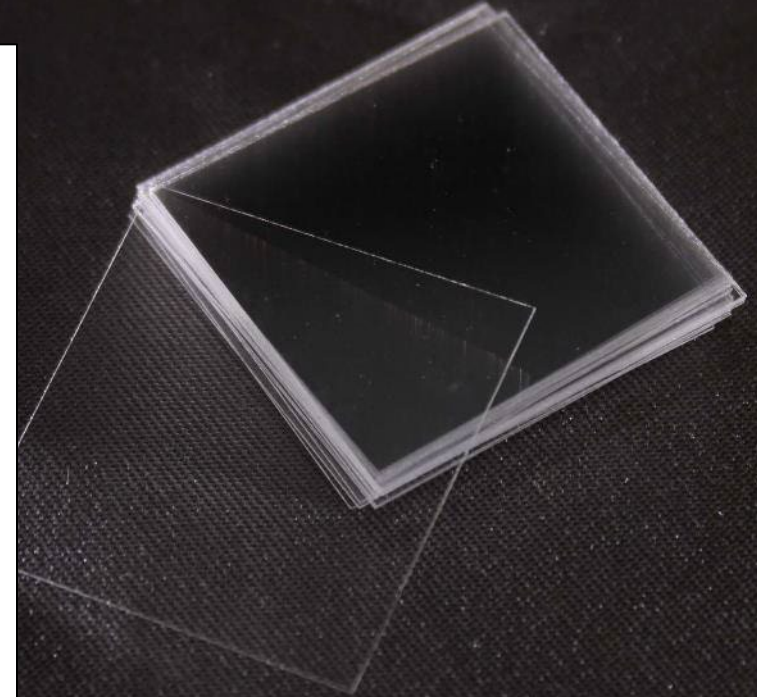
- Microscope slides have been used since the 1800s¹
- Glass was introduced and standardized by the Royal Microscopical Society in the late 1800s²
- 3x1 inch slides have been the standard since 1840²
- In laboratories, coatings have historically been applied for specialty uses of slides such as adhesive to make tissue stick to the slide



Historical Context

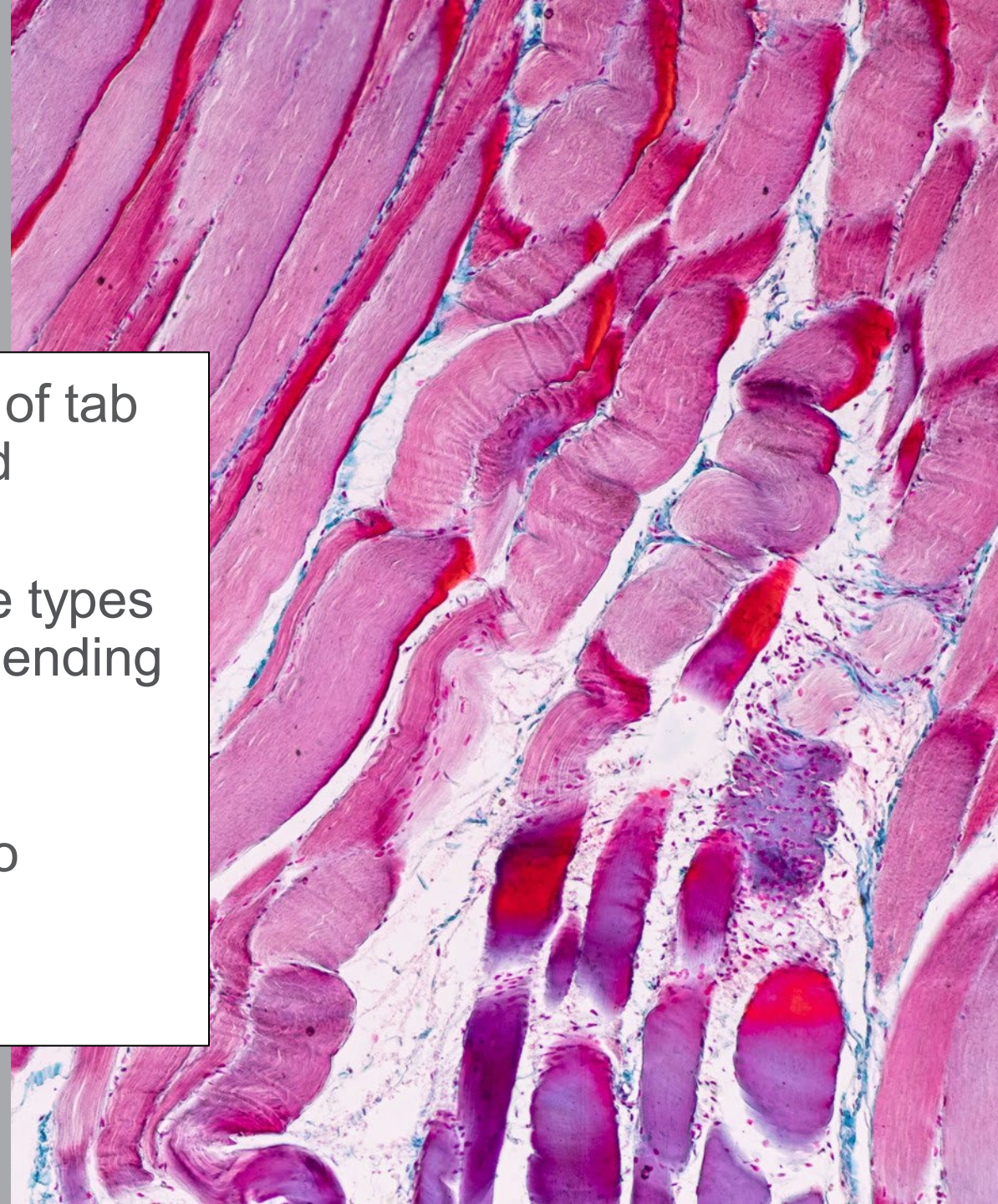
Coverglass

- Before the 1930s, coverglass was also made from soda-lime glass but was replaced with borosilicate glass in order to reduce deterioration under humid conditions¹
 - Borosilicate glass can withstand temperature changes without fracturing when compared to soda-lime glass
- Coverglass thickness was not standardized until 1953 when the Standards Committee of the Royal Microscopical Society specified the desired thickness of coverslips should be 0.18 mm¹

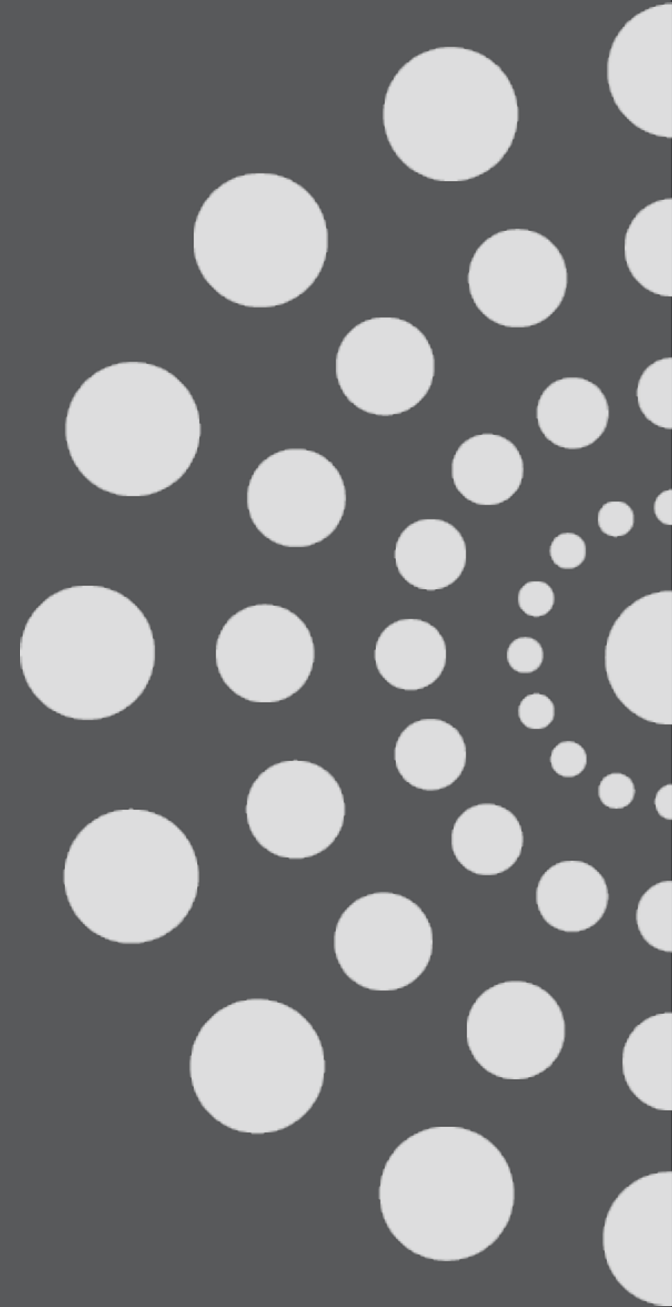


Microscope Slides

- Microscope slides are available in a variety of tab types, colors, sizes, thicknesses, edges and corners
- Depending on the application, different slide types may be used to achieve optimal results depending on the specimen type being viewed
- A variety of tab options are available to be compatible with slide printers with the aim to minimize patient identification errors



Manufacturing



Microscope Slide Manufacturing

Microscope slide manufacturing has improved over time to where clean, clear and reliable slides can be purchased for use in the lab

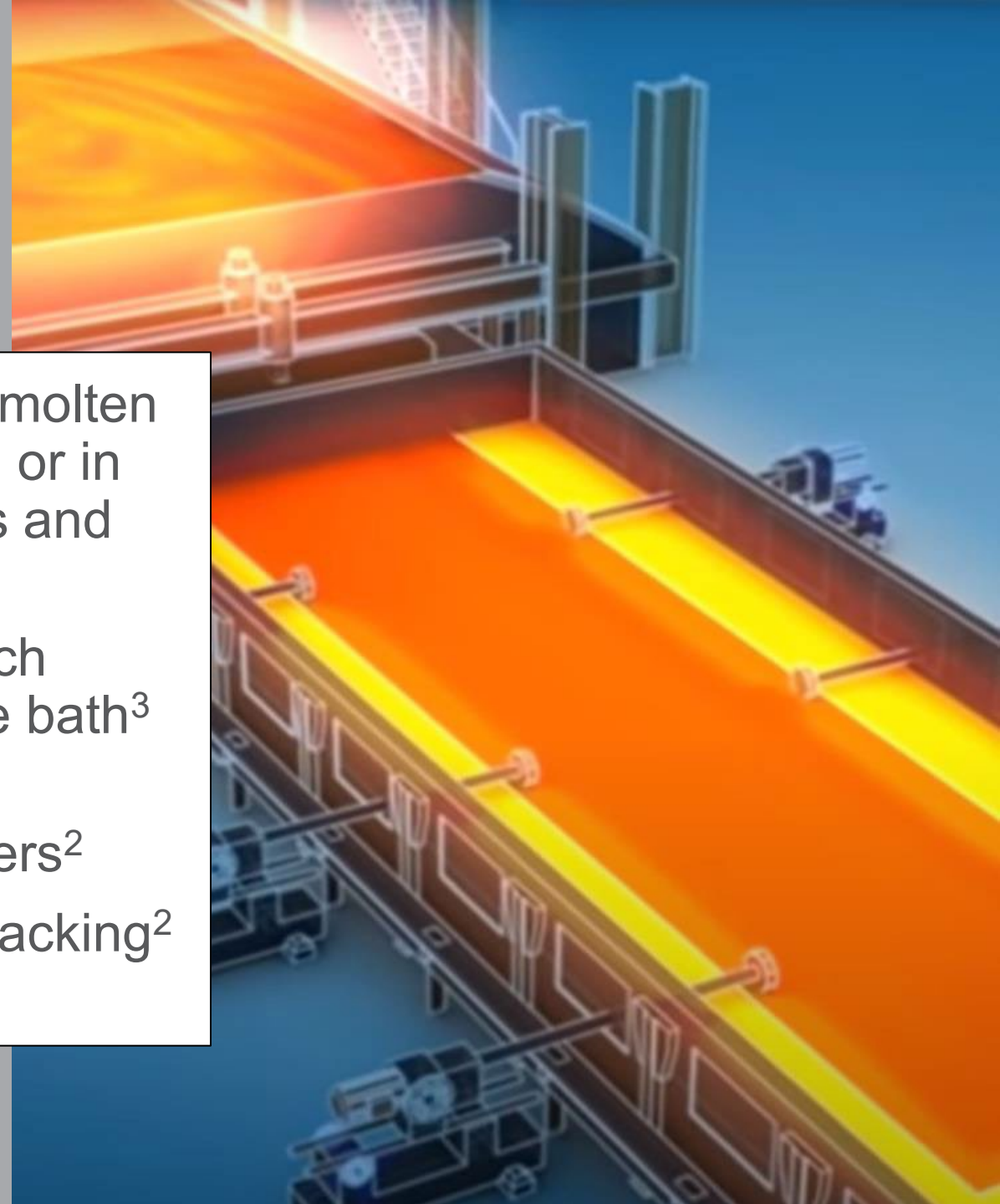
- Slide manufacturing facilities often have accreditations such as ISO 9001 and ISO 13485



How it's made

Glass Sheets

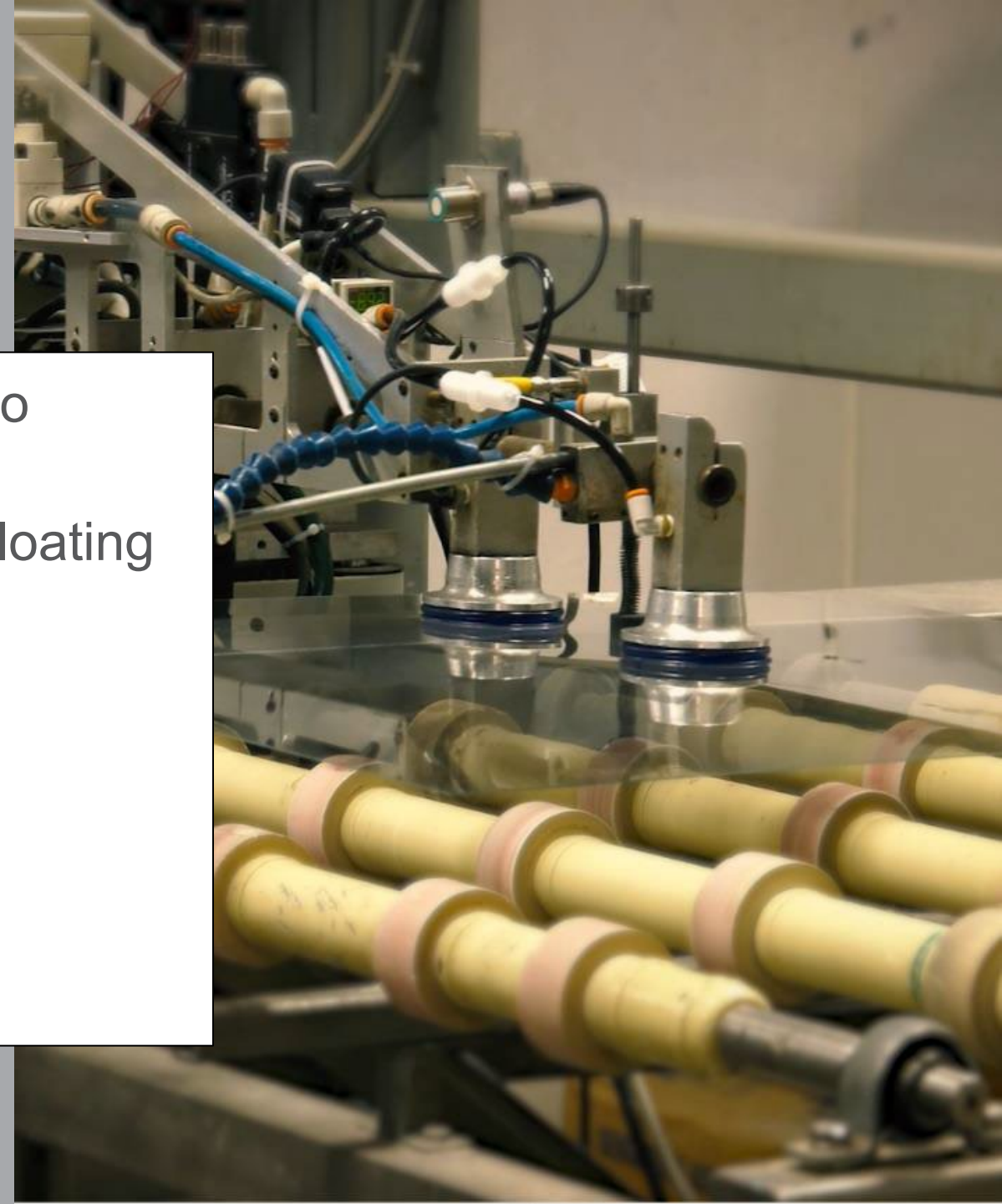
- Large sheets of glass are made by floating molten glass on a bed of molten metal, such as tin, or in the past, lead, to create a uniform thickness and flat surface¹
- Thickness is controlled by the speed at which solidifying glass ribbon is drawn off from the bath³
- The temperature of the glass sheets is then reduced so the glass can be pulled into rollers²
- Sheets are then cooled slowly to prevent cracking²



How it's made

First cleaning

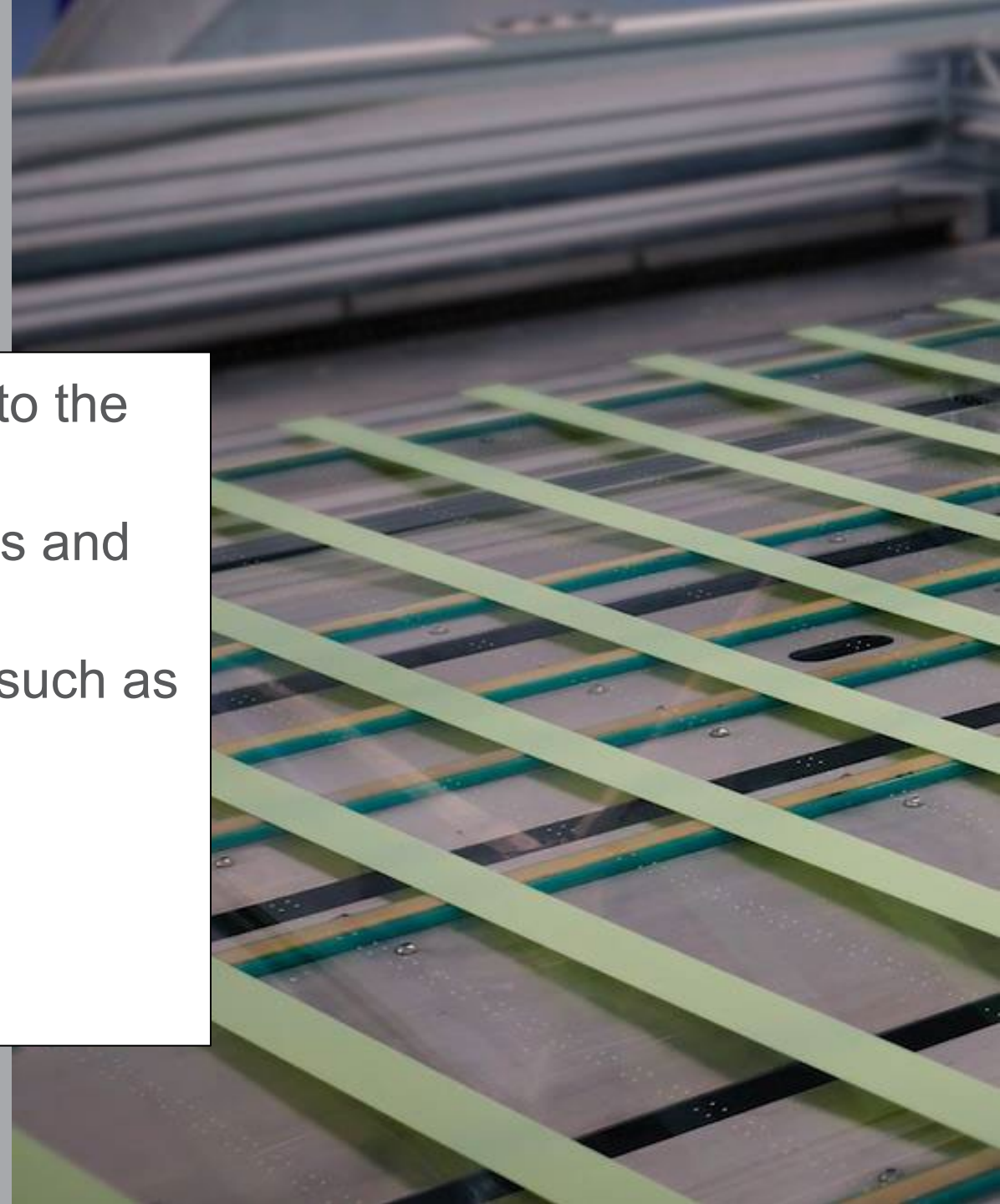
- Glass sheets are separated and loaded onto conveyor belts
- Sheets are cleaned from any debris in the floating or cooling process



How it's made

Tab Application

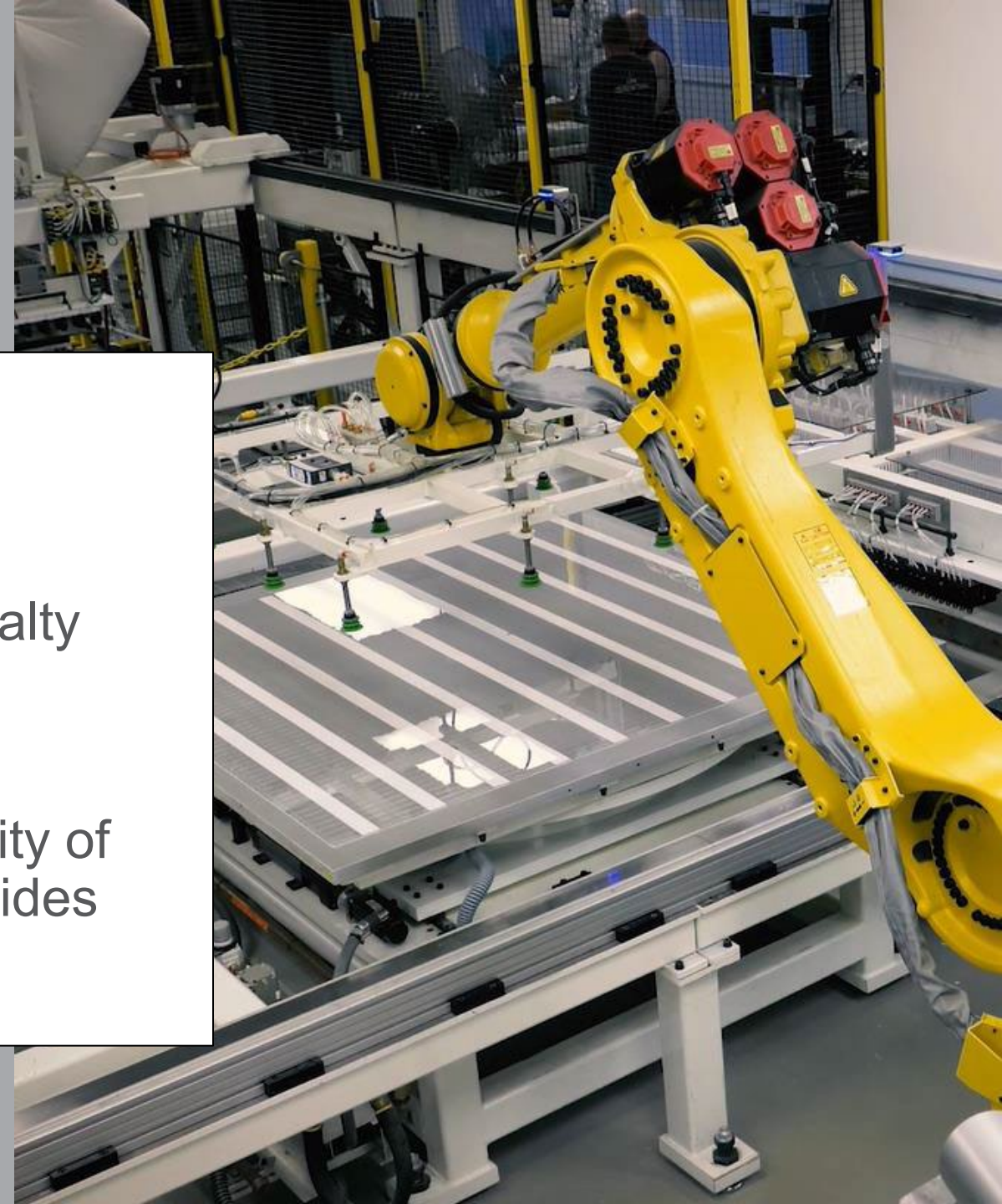
- Tabs and orientation indicators are applied to the glass sheets
- Sheets are inspected for defects in the glass and the ink application
- Ink types vary based on downstream need such as printing and labeling



How it's made

Cutting to Size

- Slides are then cut to the appropriate size
- Most microscope slides are 76x26x1mm or 3"x1"x1mm thick
- Slides are available in many sizes for specialty uses in the laboratory
- Edges are then smoothed based on the utility of the slide, such as creating clipped corner slides



How it's made

Washing

- Slides are again washed to remove debris from the cutting and smoothing process
- The method of washing can impact the slide performance in the laboratory
 - Increase slipperiness
 - Addition of adhesion treatments

How it's made

Packaging

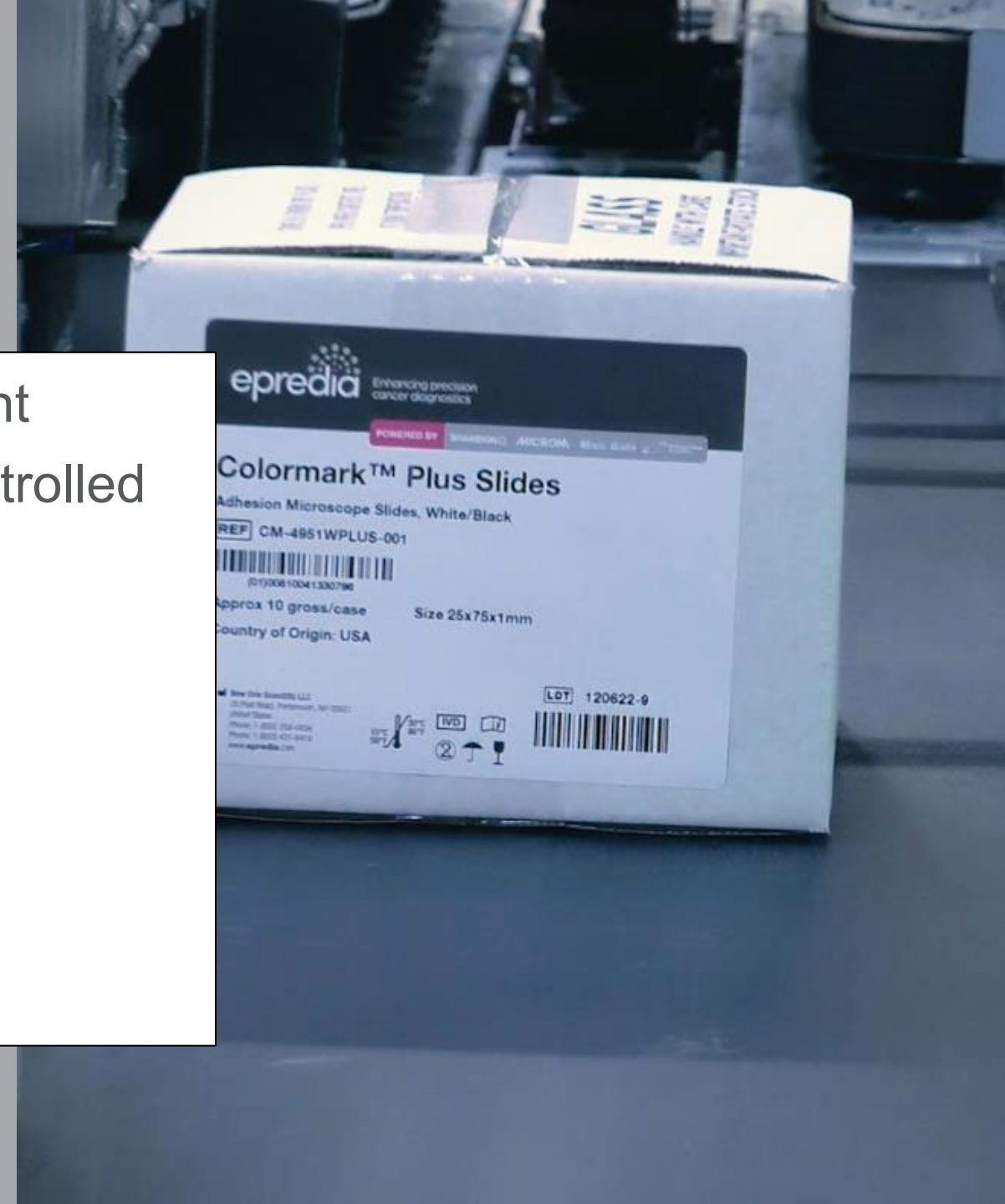
- Slides are packaged into boxes
 - Historically 72 slides are in each box
 - Slides also available in 50 or 100 slides per box
 - Many sales of slides are by the gross, or 144 slides



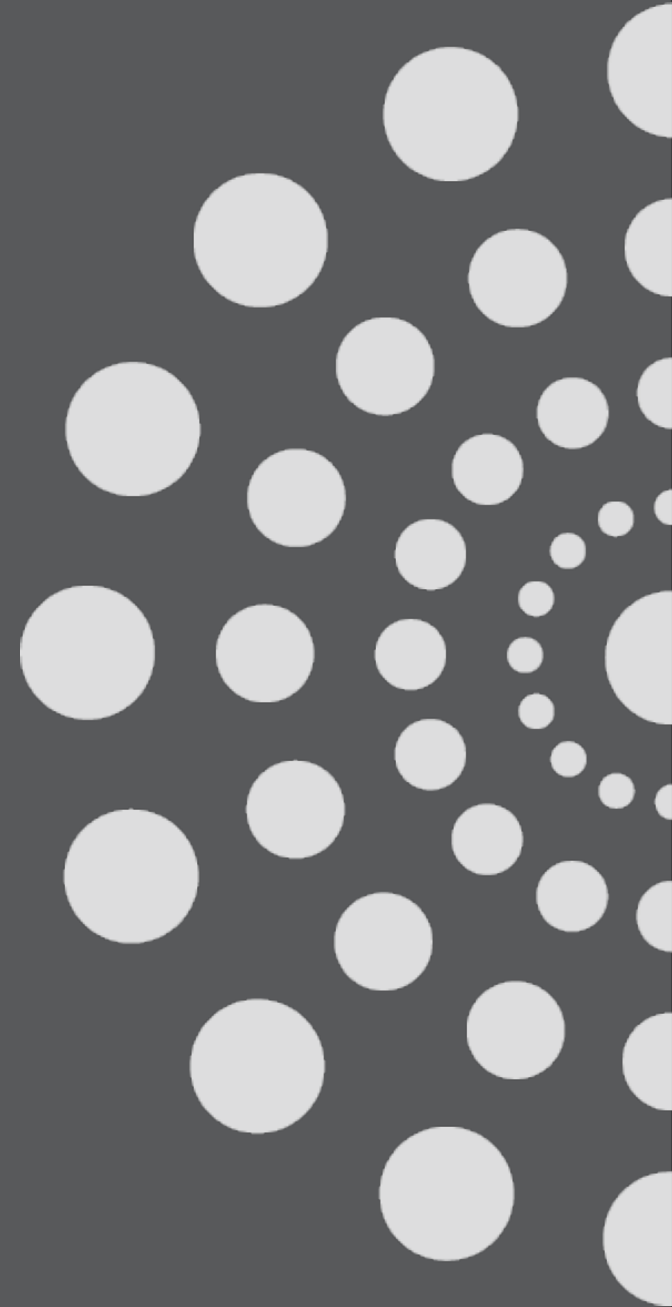
How it's made

Packaging and Shipment

- Slides are packaged into cases for shipment
- Slides should be stored in temperature-controlled environments as to not damage the glass



Microscope Slides and Coverglass



Characteristics of Microscope Slides

- White glass slides are made of low-iron, optically clear, soda lime glass
- White glass vs Green glass
 - Green glass is usually cheaper and is not as transparent due to higher iron content
 - The greenish color comes from a mixture of ferrous oxide (FeO) and ferric oxide (Fe_2O_3) in the glass¹



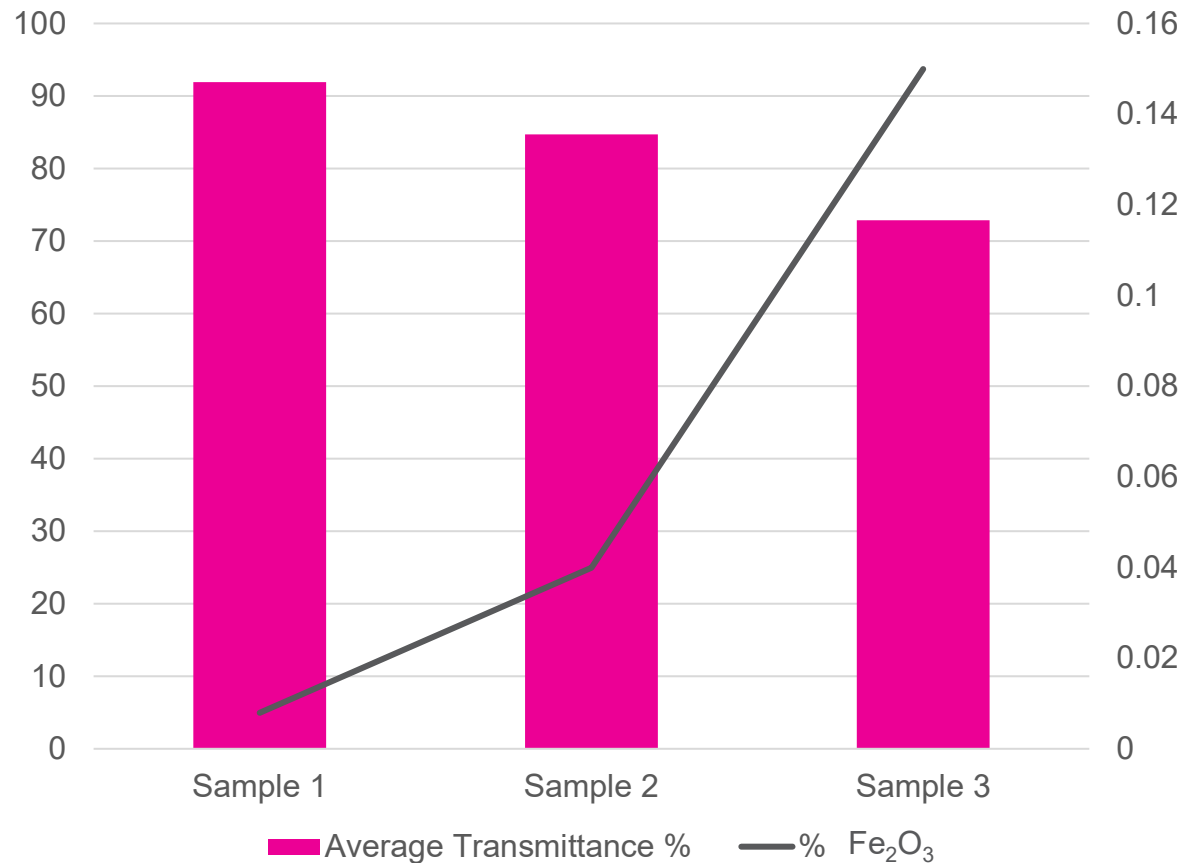
Green glass



White glass

Characteristics of Microscope Slides

Ferric Oxide vs Spectral Transmission¹



Example of Soda Lime Glass Composition

Main Glass Chemical Composition

Silicon dioxide (SiO ₂)	69 - 74 %
Sodium oxide (Na ₂ O)	10 - 16 %
Calcium oxide (CaO)	5 - 14 %
Magnesium oxide (MgO)	0 - 6 %
Aluminium oxide (Al ₂ O ₃)	0 - 3 %
Trace elements (FeO, etc.)	< 5 %

Light Transmission

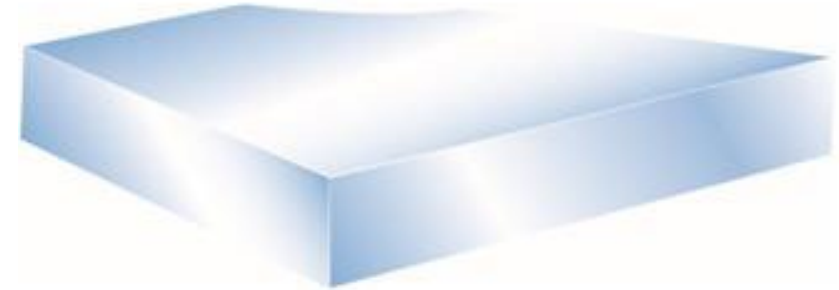
91.7%, Illuminant D65 at 2° (acc. +/- 0.2 %)

Refractive Index

1.5163, at lambda = 589.3 nm

Microscope Slide Edges and Corners

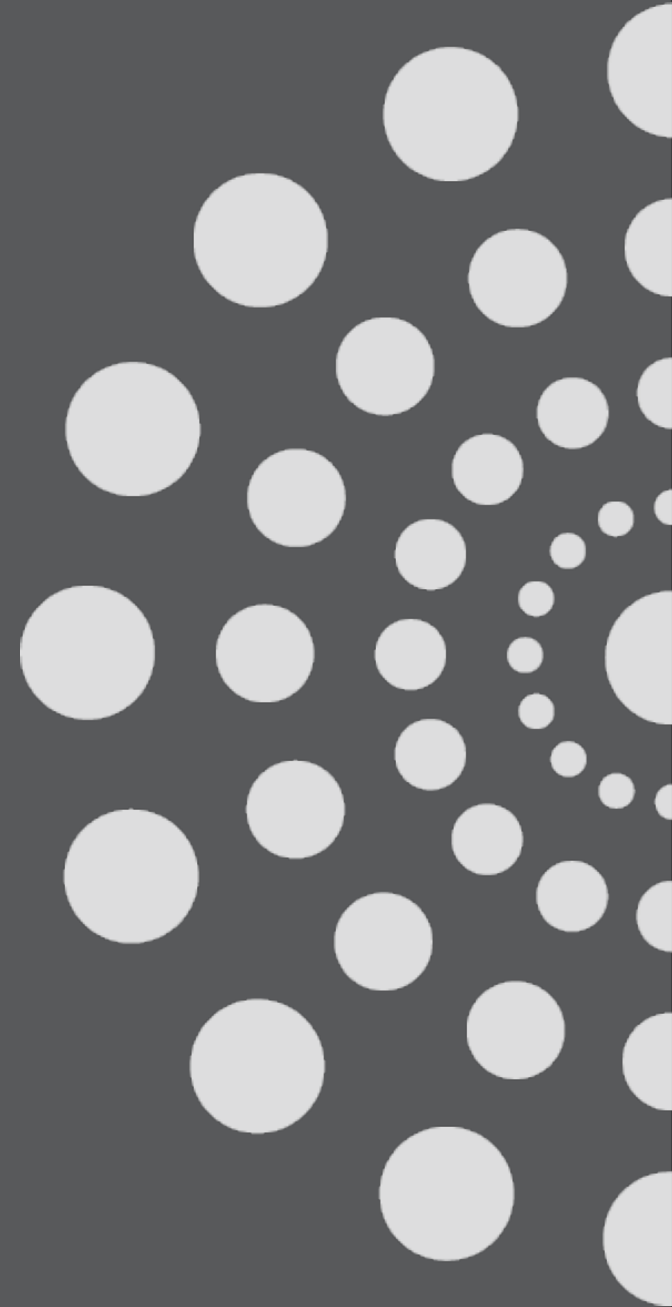
- **Cut Edges** – feature no smoothing process and are usually rough and sharp to the touch
- **Ground Edges with 90° Corners** – finely ground on all four edges of slides with 90° corners
- **Ground Edges with Clipped Corners** – finely ground on all four edges of slides with 45° corners
 - Used for blood smears and some automated slide printers
- **Ground 45° Edge (beveled) with Clipped Corners** – finely ground into bevels on all four edges with 45° corners



Poll Question

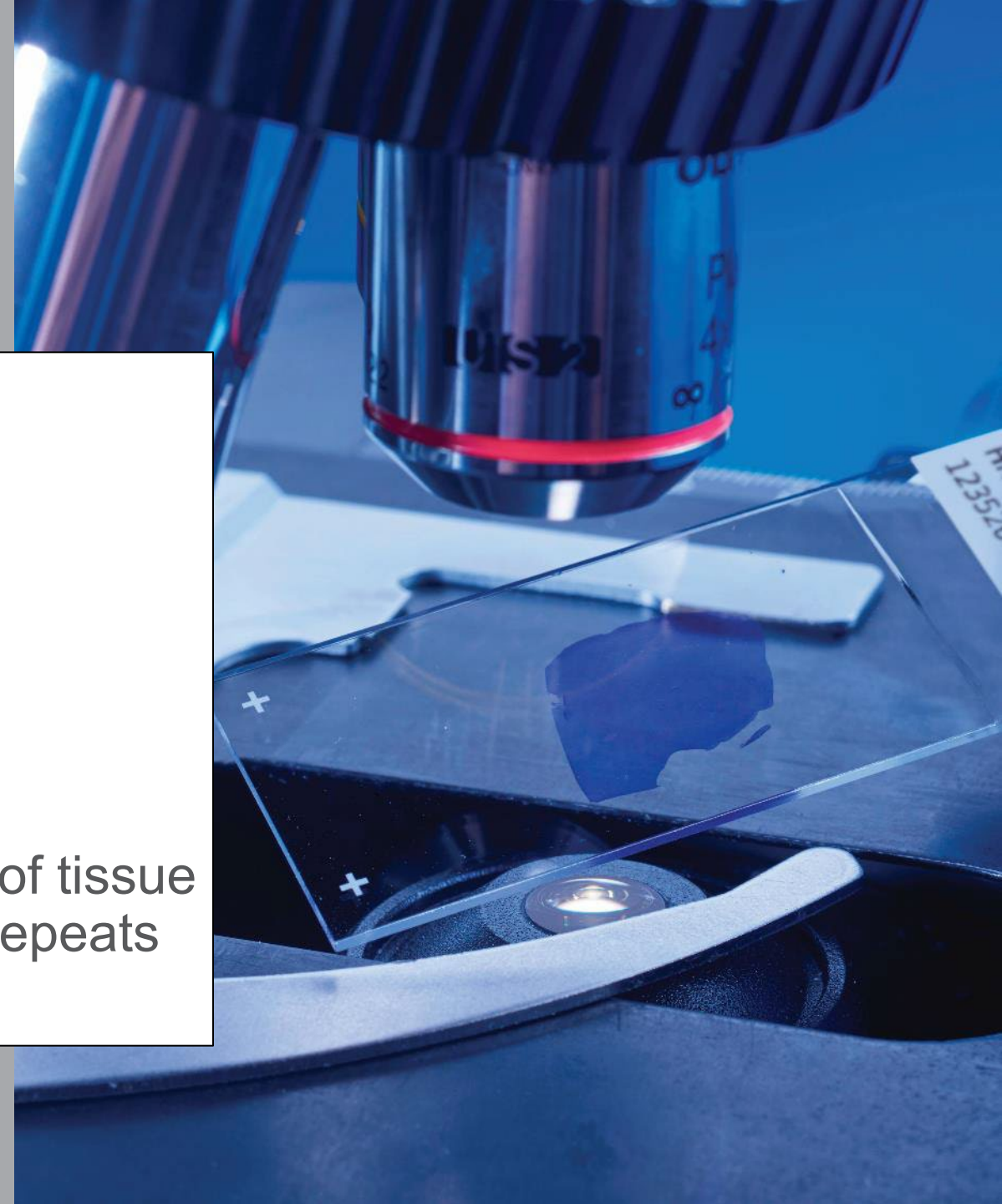
- **What type of slides are more commonly used in your lab?**
 - Cut Edges
 - Ground Edges with 90° Corners
 - Ground Edges with Clipped Corners
 - Ground 45° Edge (beveled) with Clipped Corners

Importance of Glass Slides in the Laboratory



Importance of Glass Slides in the Laboratory

- Characteristics and features of glass can help dramatically impact workflow, sample processing and diagnosis
- Quality slides can help improve laboratory turnaround time and overall operating cost
- Having to only process samples once, can significantly impact a laboratory's costs
- High quality adhesion can help reduce risk of tissue falling off/sample loss which can minimize repeats and rework



Slide Organization

- Slides are available in a variety of colors
- Tab colors can be used to organize slides
- Laboratories define color coding system, but some organization methods can be:
 - Tissue type,
 - Specimen origin location
 - Stain type
 - First cut or recut
- Some geographies require slides to be stored for >10 years so slide organization is critical



Slide Storage & Handling

- Best practices for shipping microscope slides
 - When shipping globally, ship in barrier bags to minimize humidity fluctuations
 - Additional humidity can cause microscope slides to stick together and form clumps of slides
- Best practices for storing and using microscope slides
 - Use glass on first-in-first-out basis
 - Minimize temperature changes where glass is stored
 - Store away from doors and HVAC/air conditioning ducts
 - Allow glass to equilibrate to room temperature for 24 hours
 - Store in original packaging
 - Do not store directly on concrete flooring

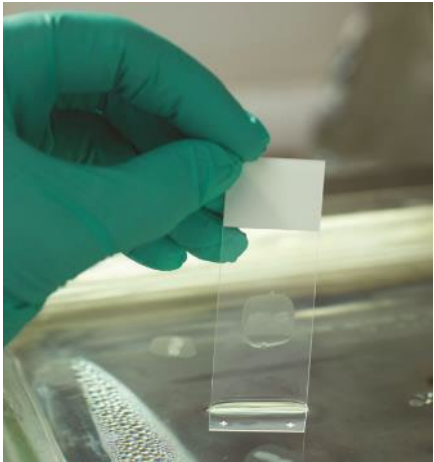
Barrier bag example



Slide Uses in Medical Laboratories

- Applications range from histology and cytology to microbiology, hematology and urinalysis
- Specialty slides can also be used in a variety of laboratory applications

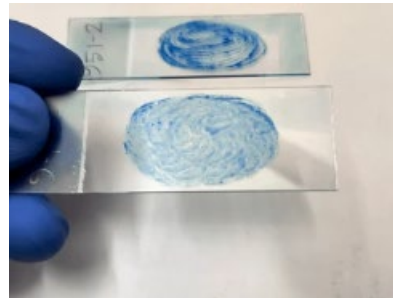
Histology



Cytology



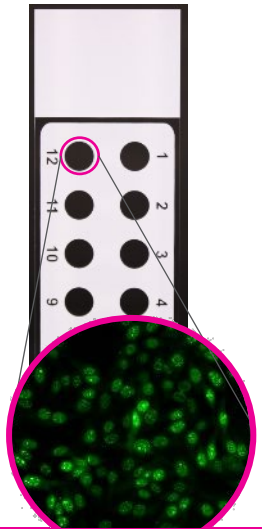
Microbiology



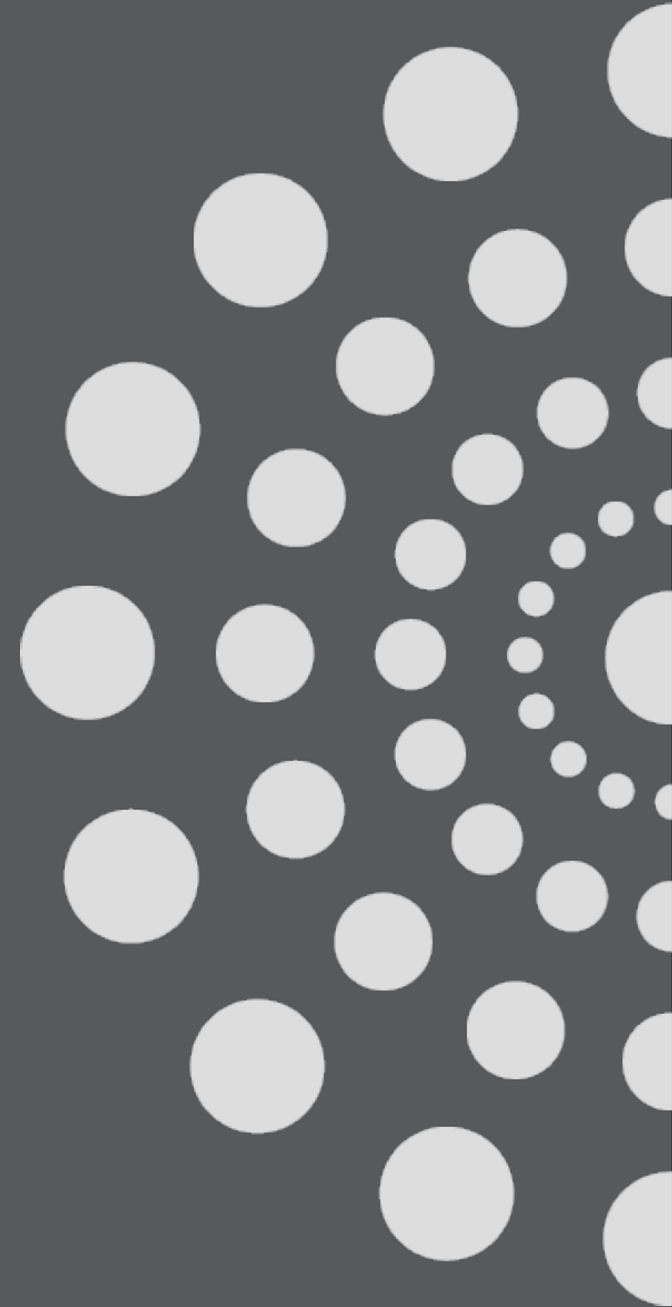
Hematology



Specialty



Adhesion vs Non-Adhesion Technology (Charged vs Non-Charged)



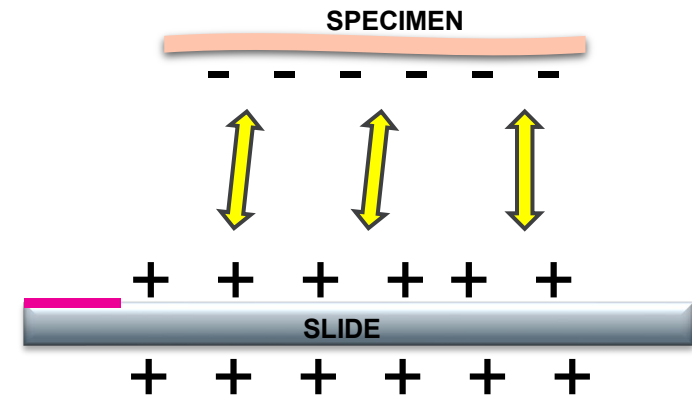
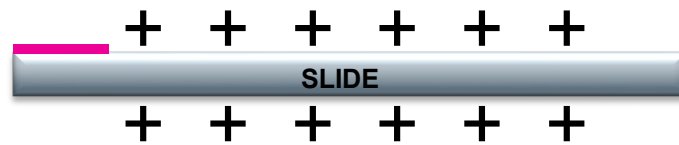
Adhesion/Charged/PLUS

- Adhesion slides have a positively charged surface created during manufacturing to attract negatively charged tissue to the slide
 - Tissue samples naturally have a negative charge
- Some adhesive slides are made with sticky glue-like substances
- Laboratories may still coat non-charged slides with adhesives such as egg white to create a sticky surface for cells to attach



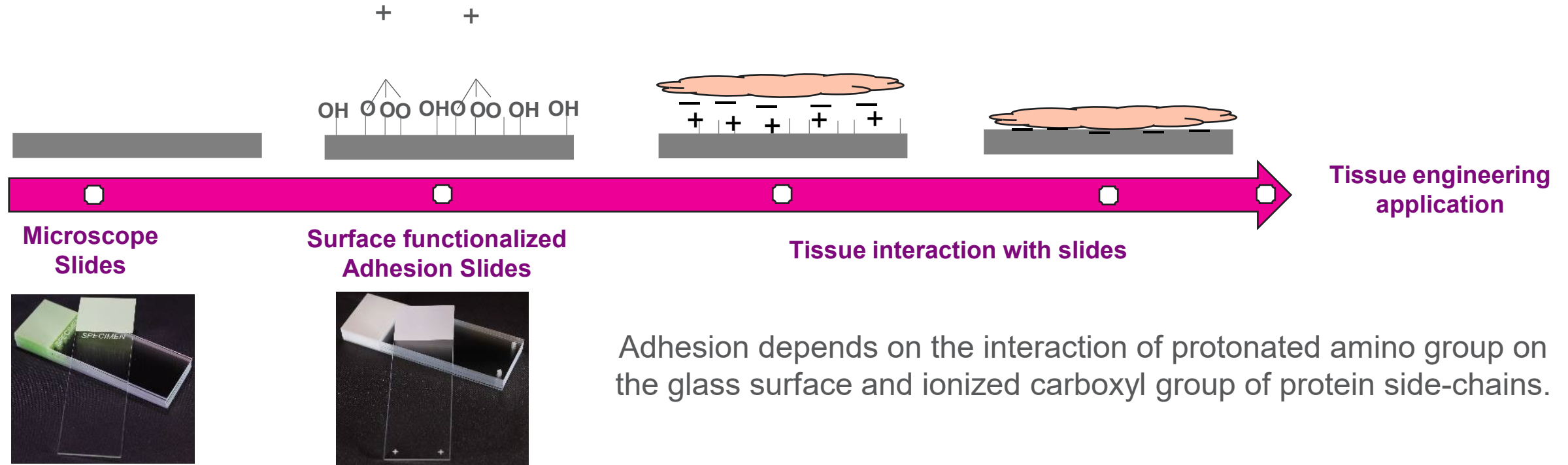
Adhesion Technology

- Negatively charged tissue specimens are attracted to a positively charged slide
- Many slides have positive charges on both sides
 - Critical to know which side has the tab so fiduciary markings become important during tissue preparation



Adhesion Technology

- Starch paste, poly(vinyl acetate) (white glue), egg albumen and gelatin are sticky substances composed of large molecules that can intervene between the apposed surfaces of the section and the slide, filling in any irregularities.
- Polylysine, amino silanes, chrome gelatine are also used in the adhesion technology.



Hydrophobic vs Hydrophilic Slides

- Hydrophobic example



- Hydrophilic/non-hydrophobic example



Histology tissue and staining reagents need to spread out evenly on the slide, which type of slide is best for consistent spreading?

Poll Question

- **What type of slide do you prefer in your lab?**
 - Hydrophobic
 - Hydrophilic

Adhesion technology

- Charged slides with excellent adhesion properties

Importance of adhesion technology in the lab

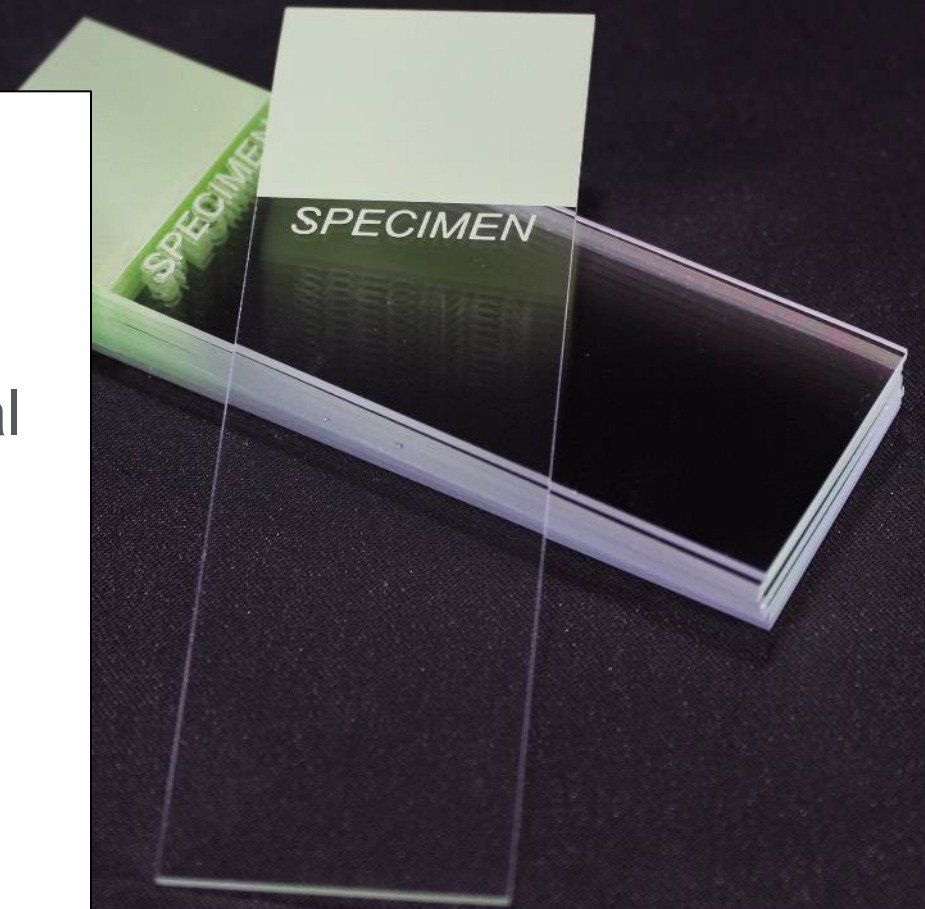
- Avoids additional chemical handling and cost
- More secure adhesion critical for difficult specimens
- Lower risk of sample loss during staining procedures

Risk of poor adhesion quality in the lab

- Tissue detachment/tearing
- Poor staining
- Extended drying times – changing oven settings
- Protocol variations
- Slows down the diagnosis and adds costs

Non-Adhesion/Non-Charged

- Non adhesion microscope slides are cleaned but the glass is not treated
- No positive charge on the surface of the glass
- Used in areas of the lab that don't need additional adhesion such as microbiology

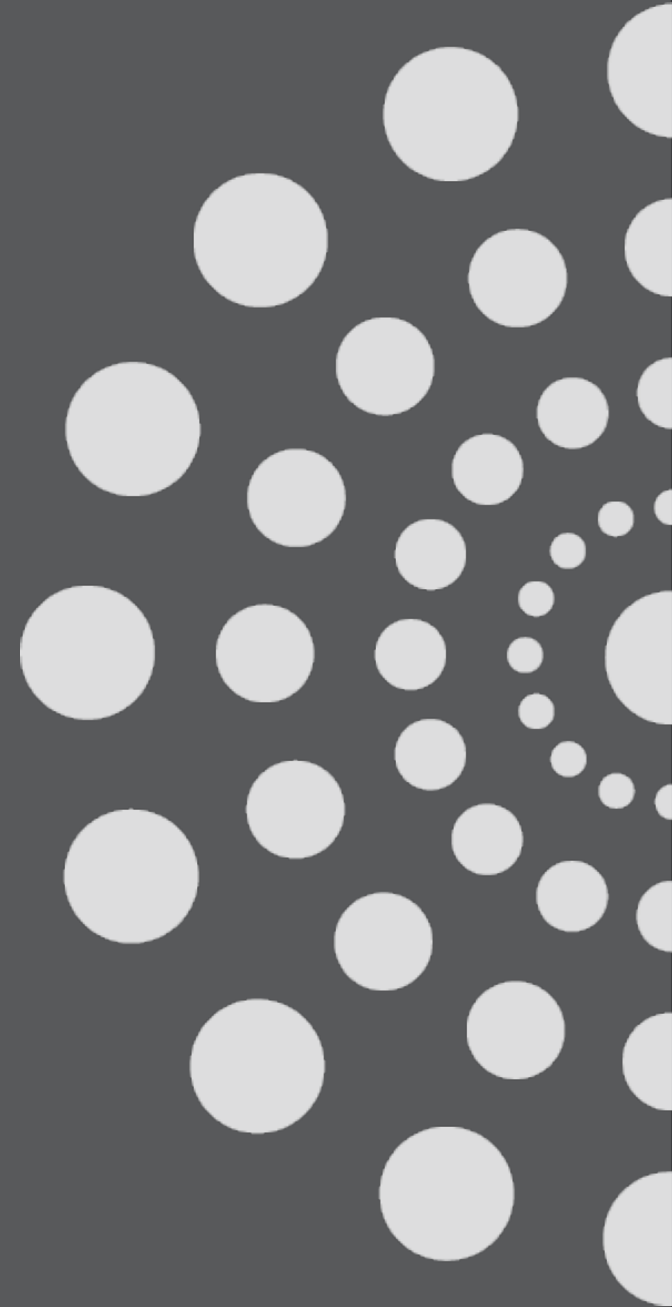


Coverglass

- Thin, clear, clean glass used to cover slides that have been processed
- Made from borosilicate glass or other materials
- Protects stained tissue from contamination and drying out
- Available in many dimensions, shapes and thicknesses
 - #1 – (0.13 to 0.16 mm)
 - #1.5 – (0.16 to 0.19 mm)
 - #2 – (0.19 to 0.23)

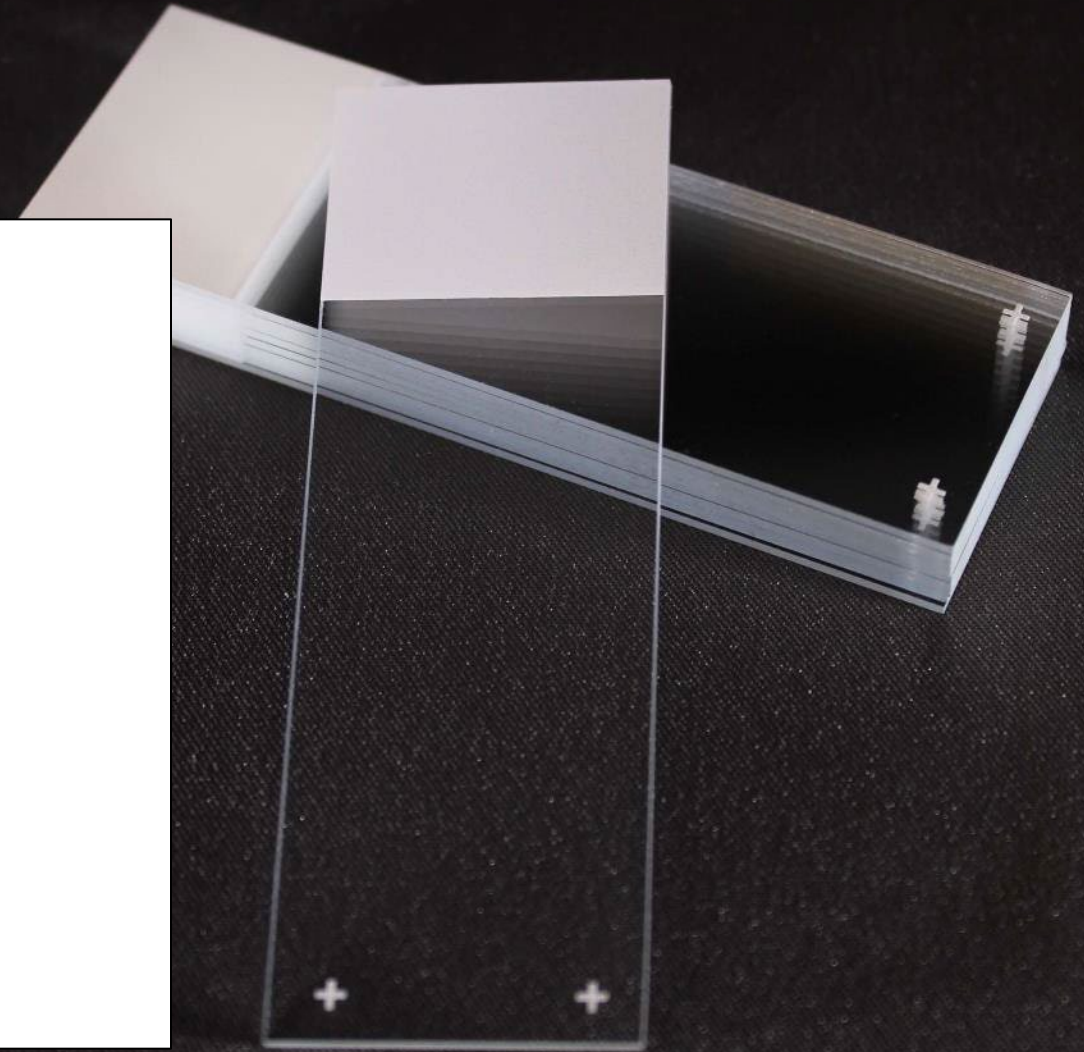


Microscope Slide Portfolio



High Quality Adhesion/Charged Slides

- Description
 - Charged slide with excellent adhesion properties
 - Reliability with automated staining platforms
- Application
 - Histology, Cytology, and IHC



Optimized Printing Slides

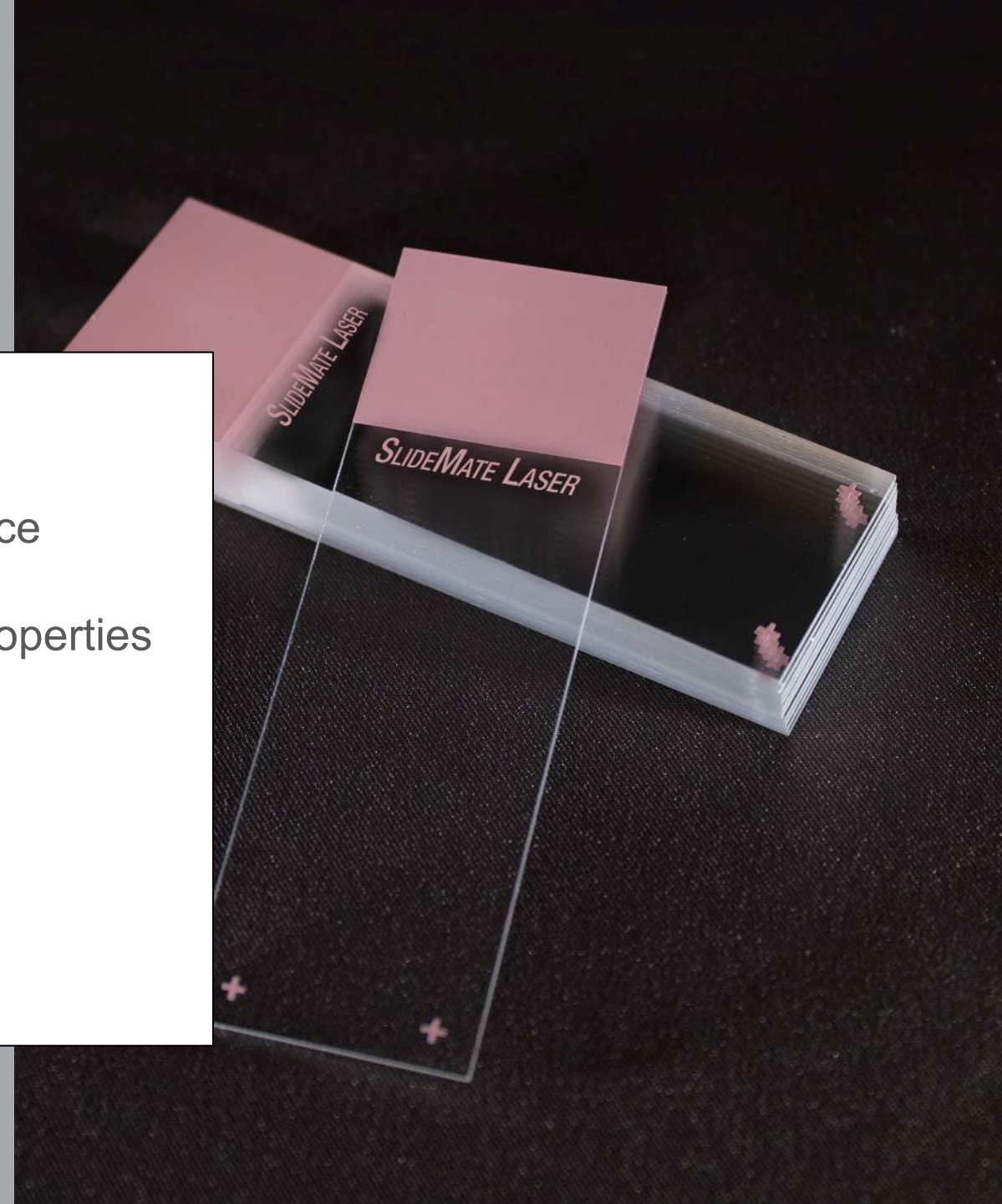
Laser Printable Slides

- **Description**

- Optimized ink on tab for laser slide printers
- Additives in ink to react with YAG laser to produce indelible marking
- Require same high-quality adhesion/charged properties to retain sample after printing

- **Application**

- Histology, Cytology, and IHC



Optimized Printing Slides

Thermal Transfer Slides

- **Description**

- Optimized ink on tab for thermal transfer slide printers
- Smooth surface for thermal transfer printers
- Require same high-quality adhesion/charged properties to retain sample after printing

- **Application**

- Histology, Cytology, and IHC



Optimized Printing Slides

Inkjet Slides

- **Description**

- Optimized ink on tab for inkjet printers
- Tab designed to absorb ink from inkjet printer
- Many inkjet slides have clipped corners
- Require same high-quality adhesion/charged properties to retain sample after printing

- **Application**

- Histology, Cytology, and IHC



Optimized Printing Slides

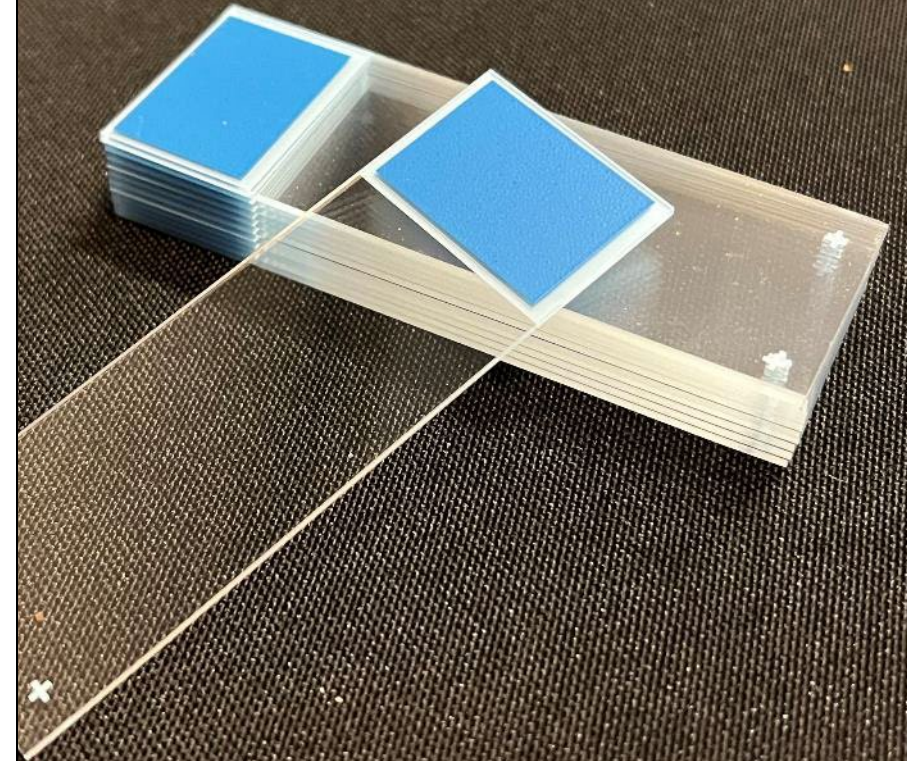
Etching Slides

- **Description**

- Tab with light color on one side and dark color on the back
- Slide etchers, that physically remove the light ink with a stylus and can see high contrast with the dark color underneath
- Require same high-quality adhesion/charged properties to retain sample after printing

- **Application**

- Histology, Cytology, and IHC



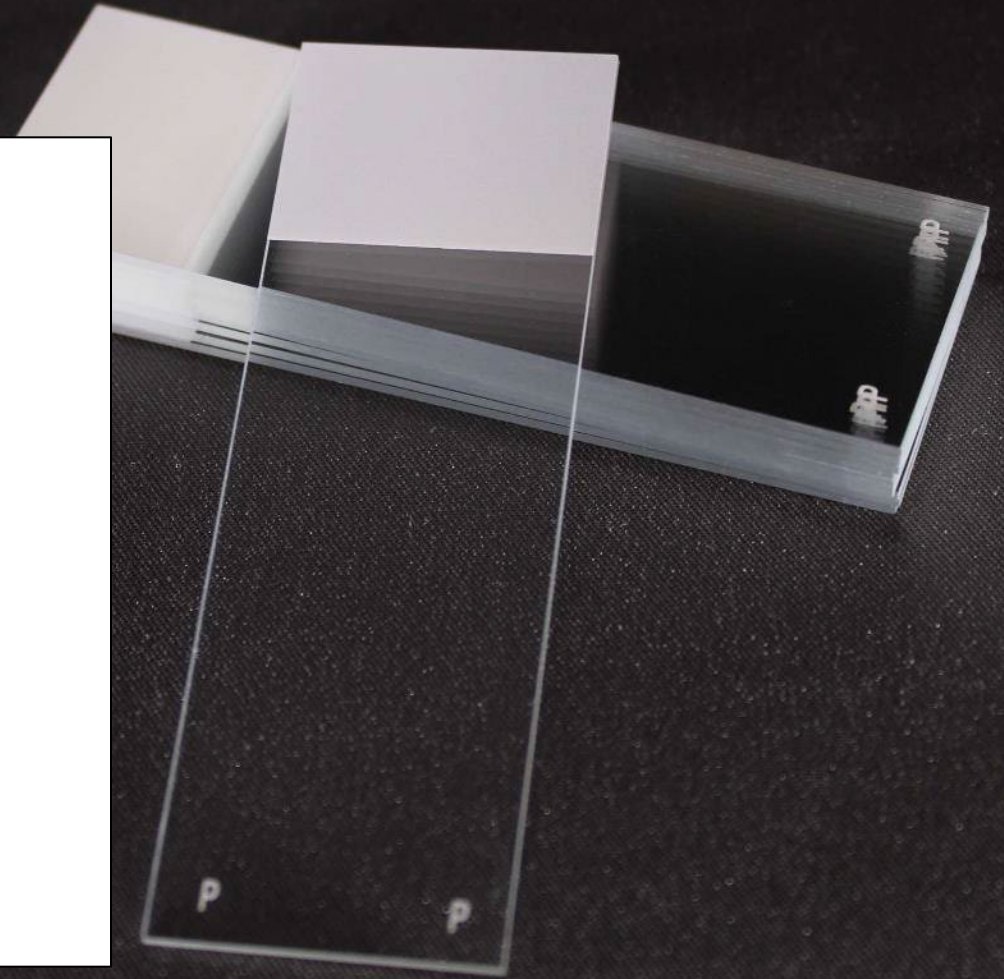
Poly-L-lysine Chemistry

- **Description**

- Adhesion coating derived of the chemistry for poly-L-lysine
- Creates positive charge on glass to attract cells

- **Application**

- Histology and cytology applications



Extra Strength Adhesion Slides

- Description

- Differentiated adhesion technology with additional slide treatment
- Sometimes uses specialized packaging used to separate slides

- Applications

- Used commonly for frozen tissue sections
- Recommended for hard-to-hold tissue samples like bone, brain, breast and skin
- Ideal for special stains, immunocytochemical and *in-situ* DNA hybridization on these tissue types



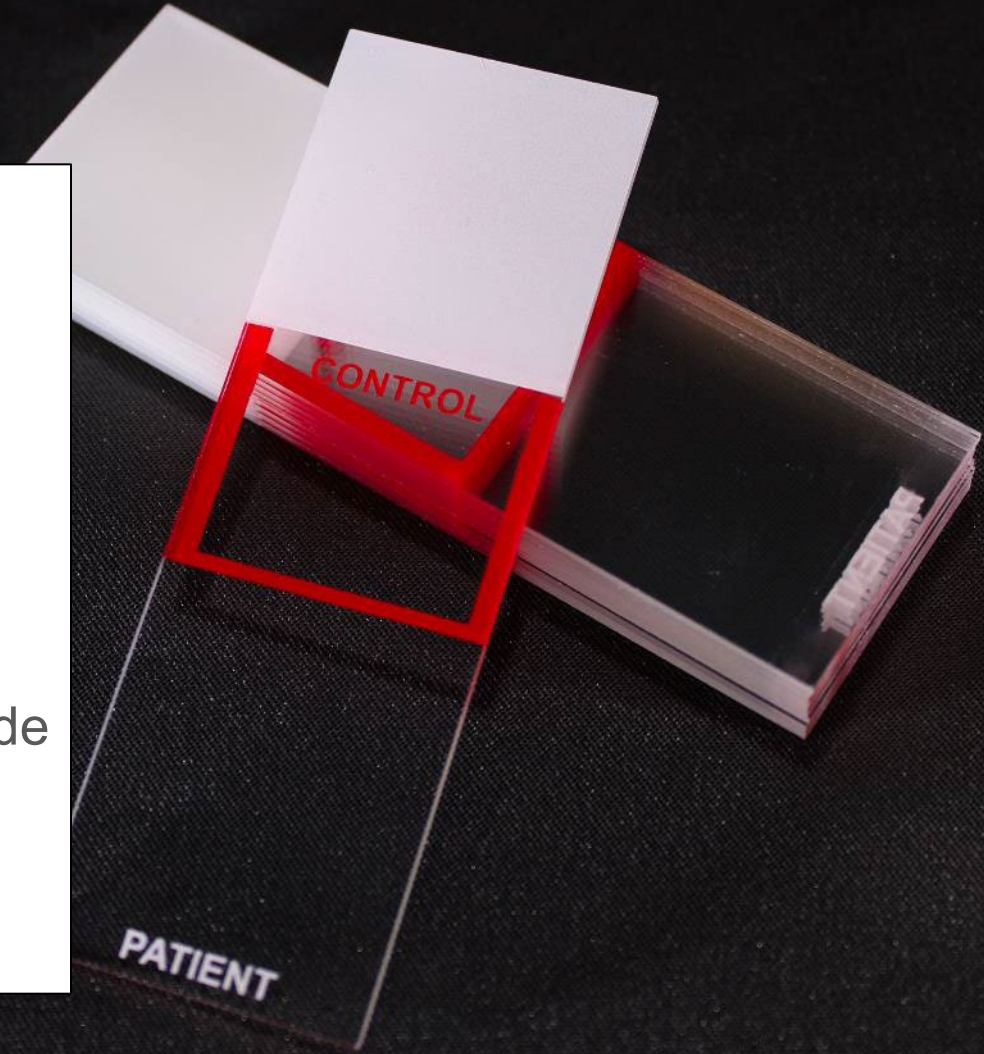
Control Slides

- **Description**

- Features control box for a secondary sample at the frosted end of the slide
- Require same high-quality adhesion/charged properties to retain patient and control material

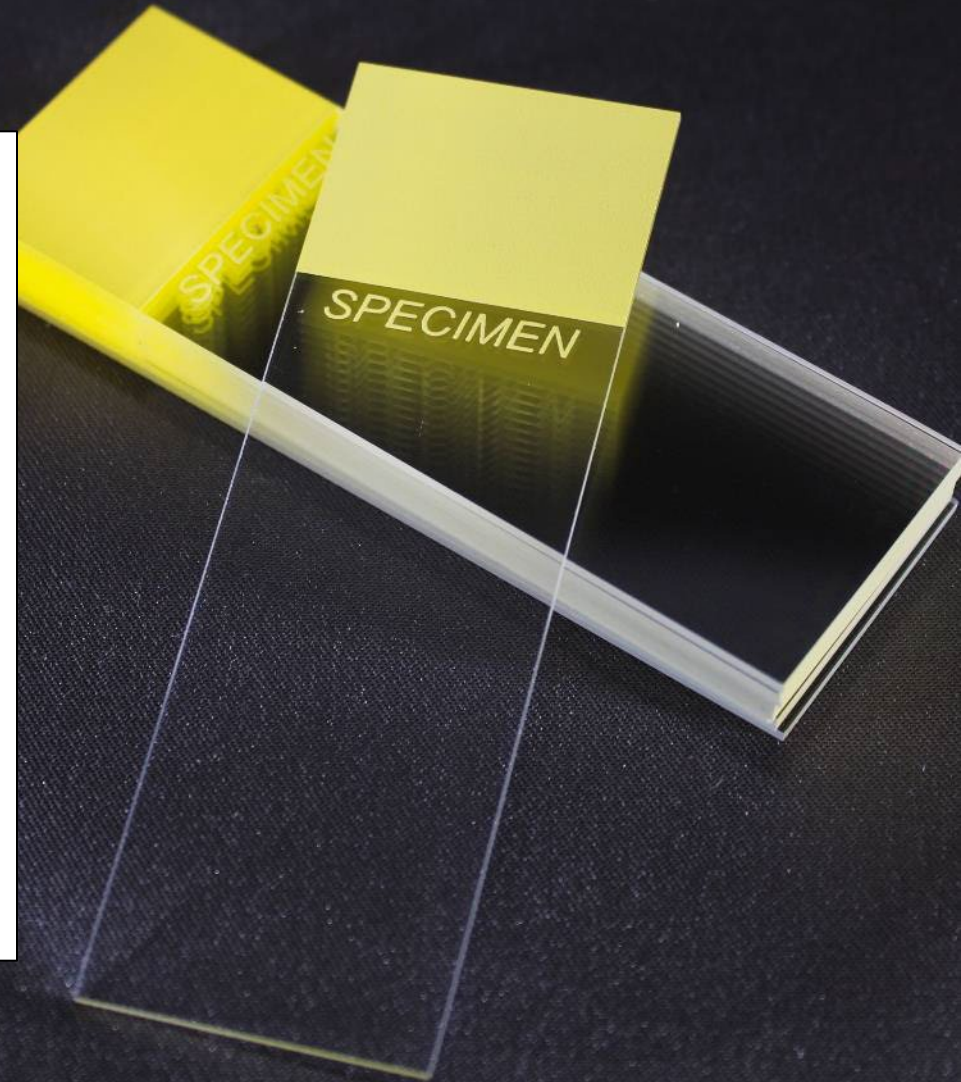
- **Application**

- Designed to run the control and sample on the same slide



Non-adhesion Slides

- Description
 - General use non-adhesion slide with high quality slide tab
- Application
 - Histology (mainly H&E), cytology, microbiology, hematology, urinalysis



Optimized Printing Slides

- Same format as adhesion printing slides but without the adhesion treatment
- Ink on the slide tab has been optimized for compatibility with specific printers
 - Laser technology
 - Thermal Transfer
 - Inkjet
 - Slide Etchers



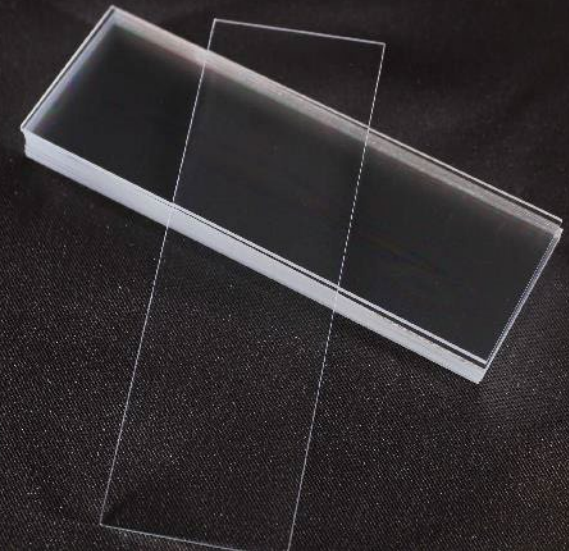
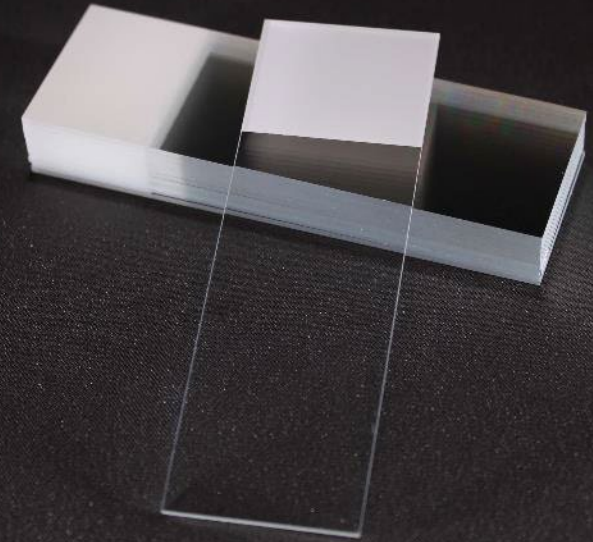
Plain and Frosted Slides

- Description

- Plain glass has no printed tab
- Frosted tab has a white frosted writing surface
- Fully frosted slides have ink on 1 or both sides
- Few manufacturers use sandblasting technique as it's harmful to the workers performing the sandblasting

- Application

- General laboratory applications in urinalysis and microbiology
- Handwritten information on tab
- Fully frosted slides can be used for fluid specimens and sometimes in cytology



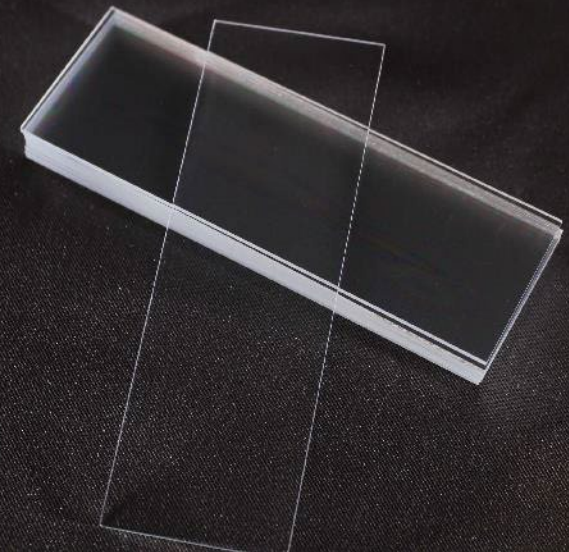
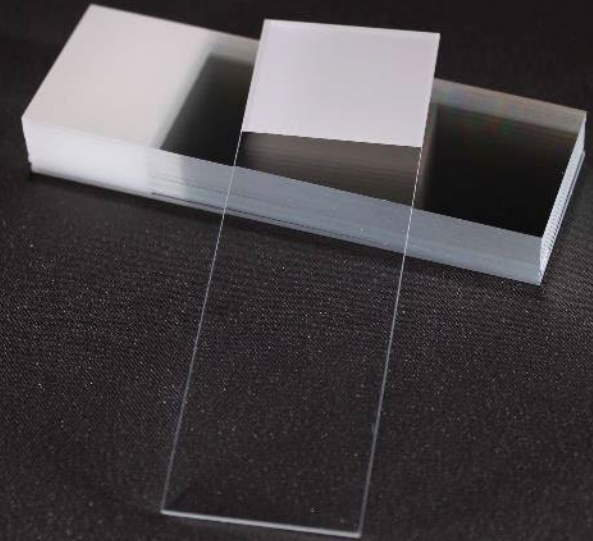
Premium Plain and Premium Frosted

- **Description**

- Specialty manufacturing process used to create slides with properties to make quality blood smears
- Slides have less friction when placed against each other
- Packaged in humidity-controlled packaging

- **Application**

- Hematology blood smears
- Non-clipped corner slides can be used in histology and cytology applications



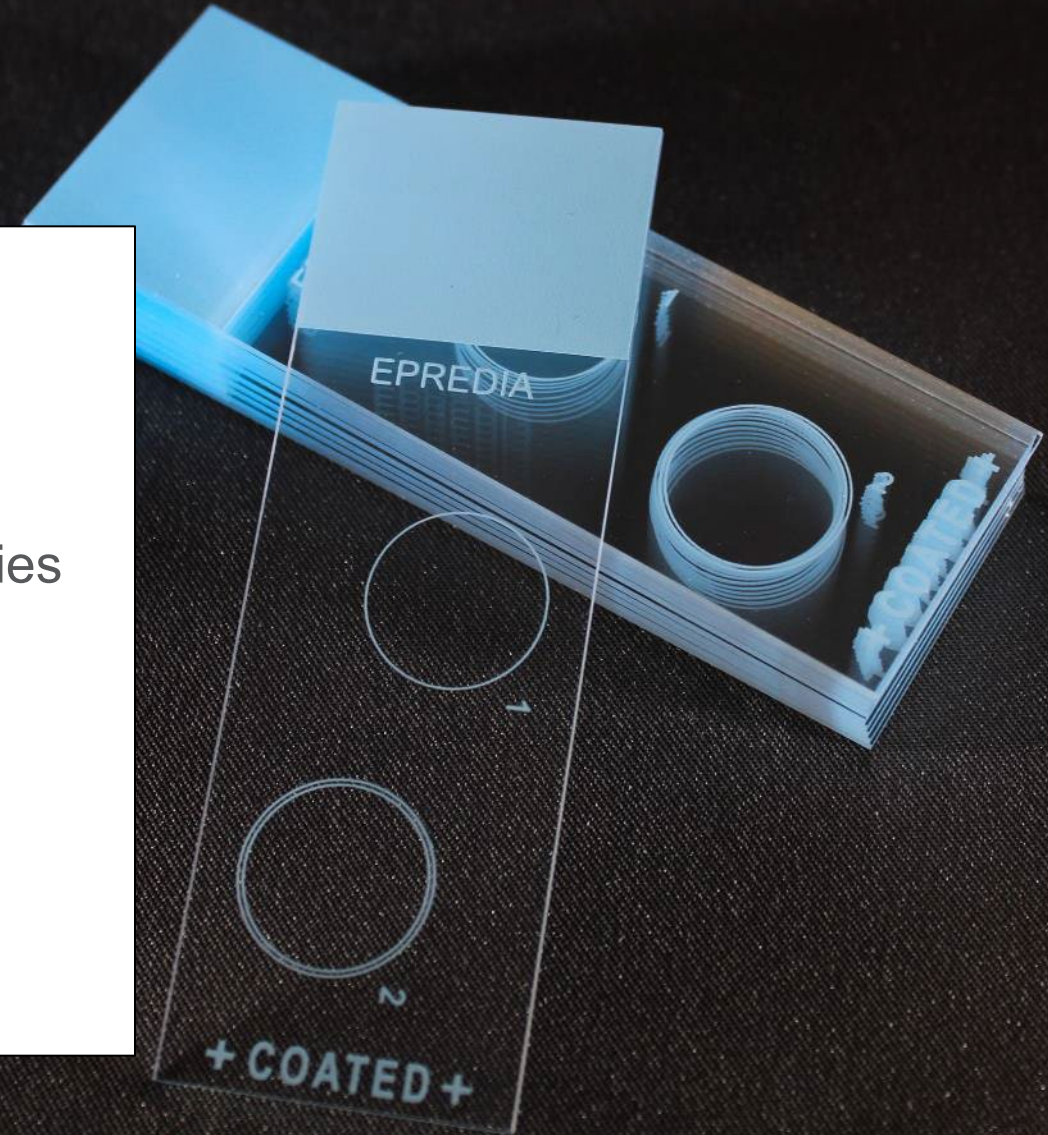
Cytology

- **Description**

- Single, double and masked options available
- Compatible with cytofunnels and cytology sample chambers
- Require same high-quality adhesion/charged properties to retain cells
- Also available in non-coated/non-adhesion varieties

- **Application**

- Cytology and customers with cytocentrifuges



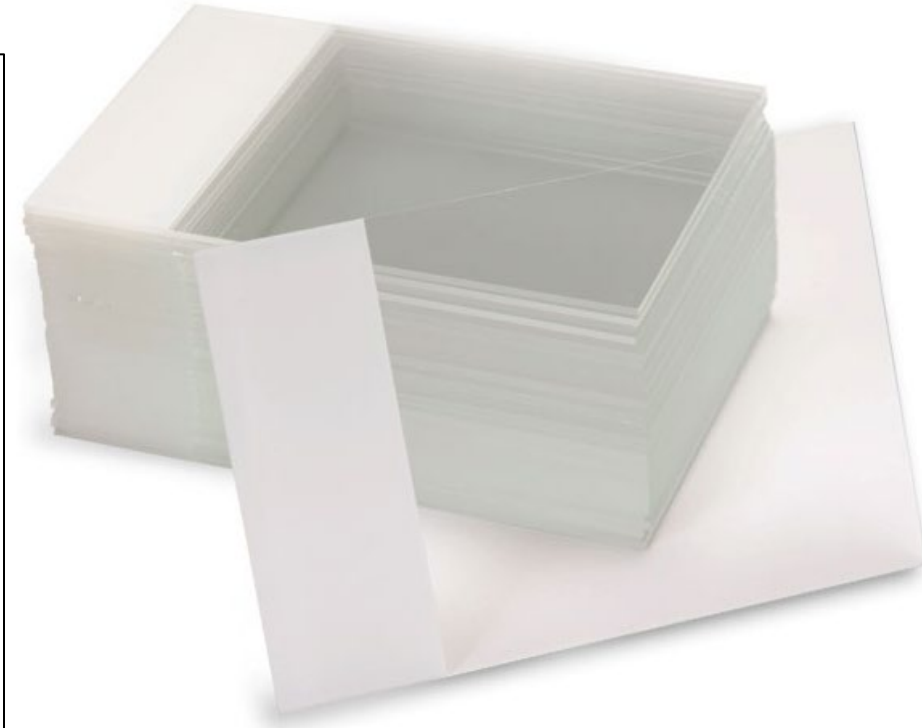
Large Format

- **Description**

- Adhesion and non-adhesion slides available in a variety of sizes and thicknesses
- Available in plain and frosted options

- **Application**

- Used for creating whole mount sections



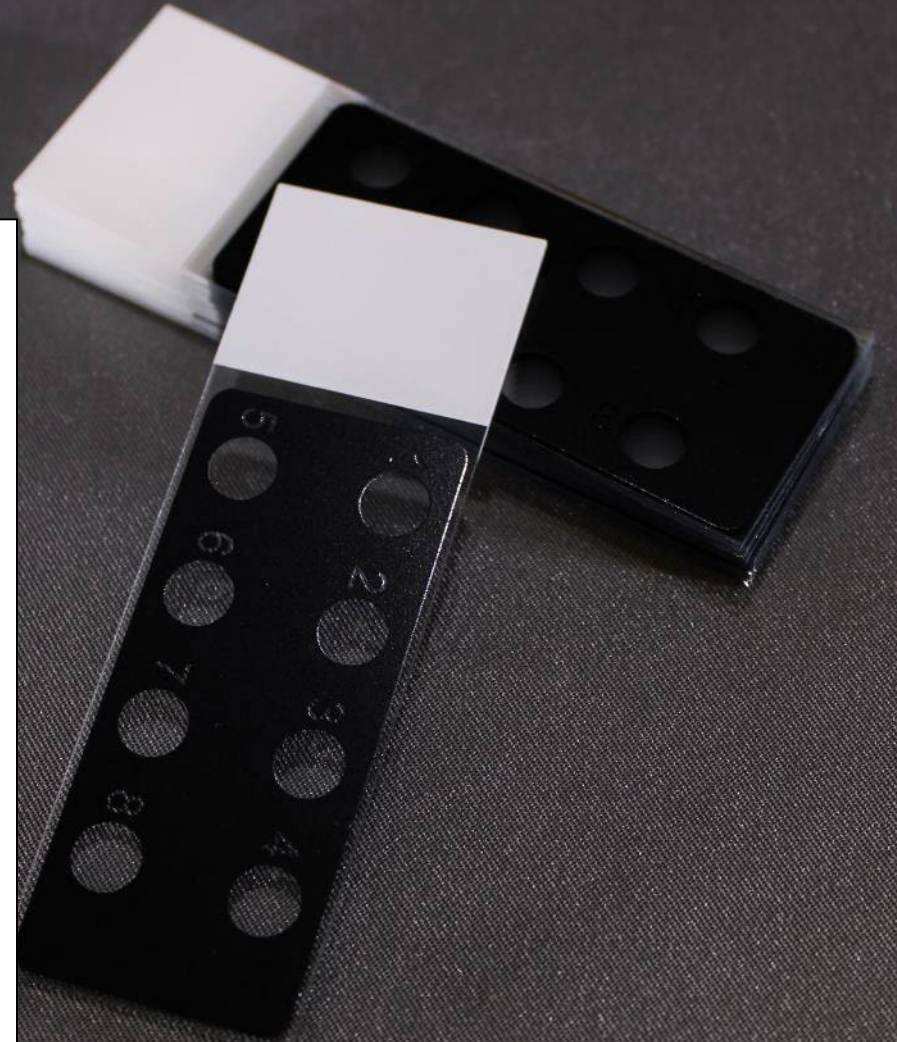
Specialty Printed Slides

- Description

- Slides with masking to block out light and easily localize cells in an identifiable location
- Hydrophobic masking
- Feature of the mask is to prevent cross contamination of multiple specimens on the same slide

- Application

- Diagnostic kits and specialty applications with multiple samples per slide



Petrographic

- **Description**

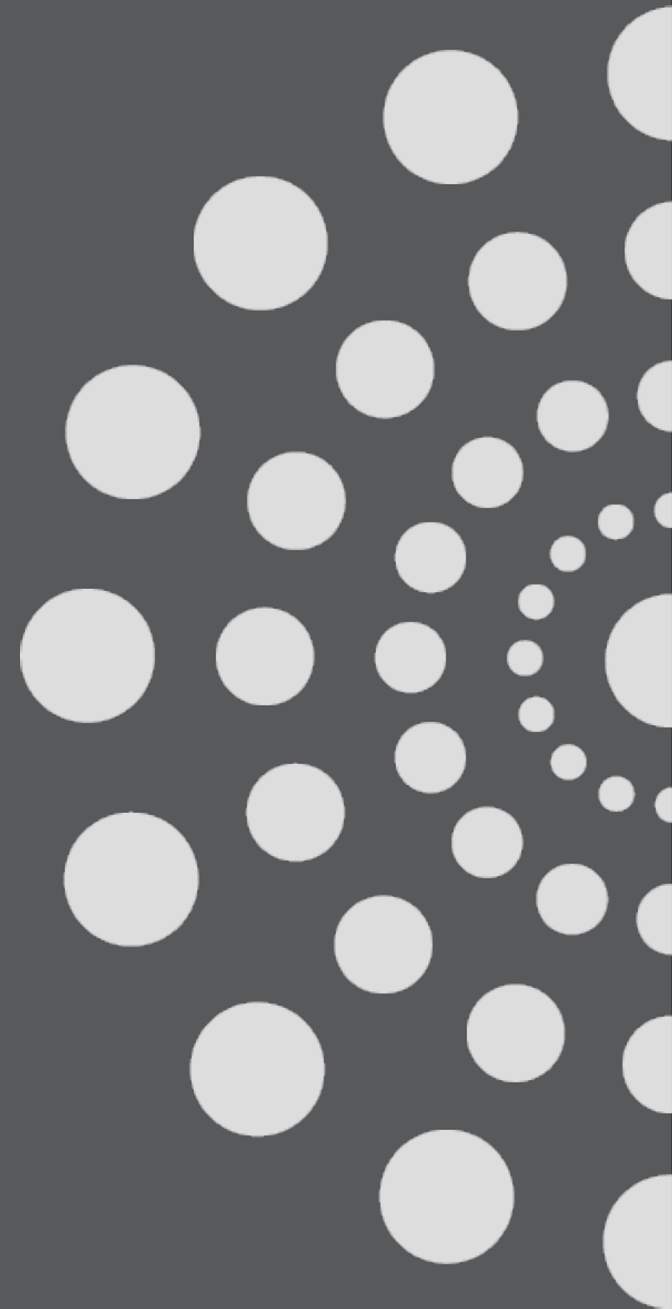
- Large format non-adhesion slides
- Available in plain and frosted options

- **Application**

- Used to mount thin sections of rocks, minerals, building materials or bone



Coverglass



Coverglass

- Coverglass is used in microscopy to hold the specimen in place to protect it from accidental contamination
- Key features of coverglass
 - High spectral transmission
 - Refractive index finely adapted to microscope objectives
 - Available in multiple sizes and thicknesses - #1, #1.5 and #2
 - Rectangles, squares, and circles

Specialty Coverglass

For automated coverslippers

- Specialty coverglass is designed and manufactured to increase slipperiness between pieces of coverglass
- Proprietary manufacturing techniques for companies
- Ideal for automation of coverslipping
- Sold in a variety of sizes in a rectangular shape only



Microscope Slides

- High-quality glass manufacturing forms the basis of laboratory testing
- Adhesion technologies can differ but should be optimized for specific applications
- Many types of slides are available, choosing the right one for an application is important

Coverglass

- Consistent dimensions and thickness are essential for manual and digital microscopy
- High spectral transmission is crucial for reliable microscopy results
- Specialty coverglass may be used in automated coverslipping solutions

Applications

- Microscope slides and coverglass are used in many key laboratory functions
- Quality of glass is critical for downstream interpretation



Content provided by EpreDia

- **High quality** slide manufacturer, always investing in new glass manufacturing technologies
- Manufacturer of **Superfrost PLUS™**, SlideMate™ PLUS and Superslip™ coverslips among other popular brands
- **Redundant manufacturing** locations for slides and coverglass
- Optimized slides for histology slide printers such as **SlideMate Laser**, AS and Pro



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