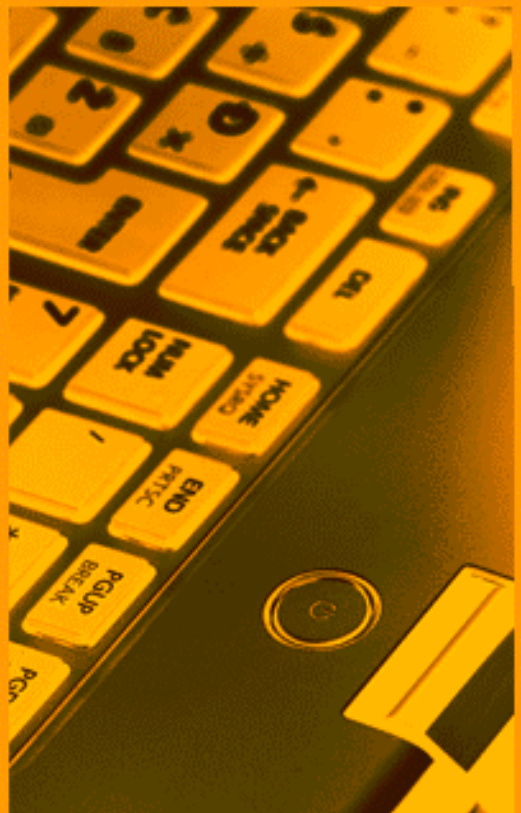
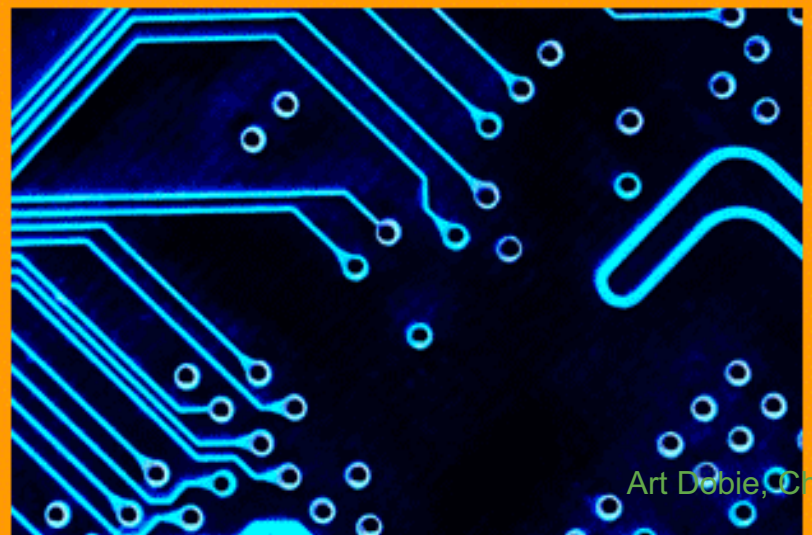
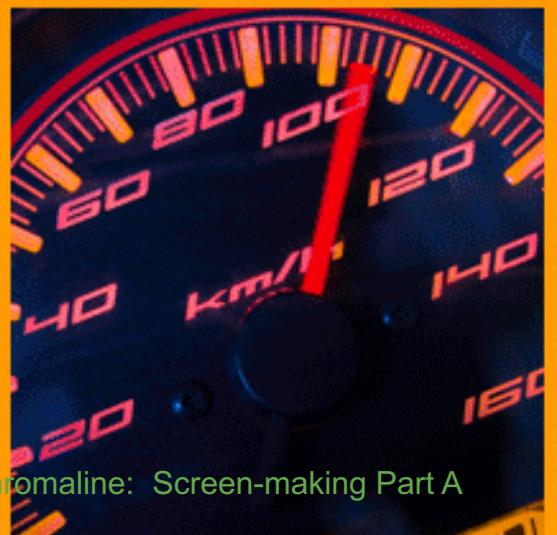
SGIA Printed Electronics Roundtable





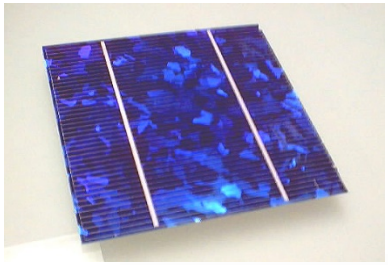


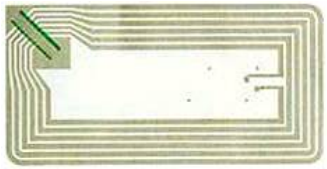


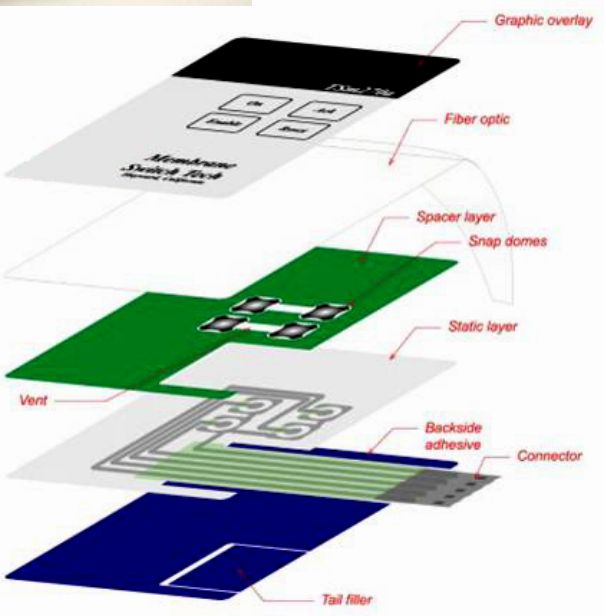


Art Dobie, Chromaline: Screen-making Part A

Screen Printing is a fast and economical method of depositing electronic materials to fabricate many different types of circuitry



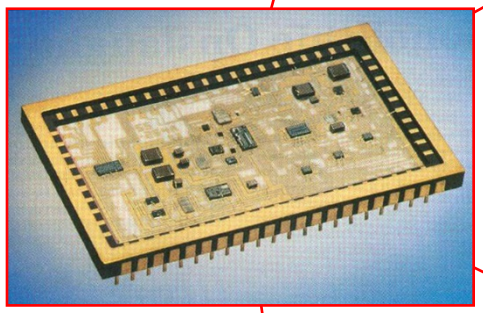


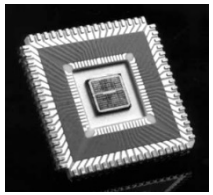


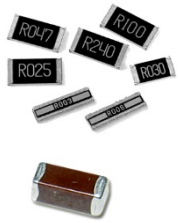




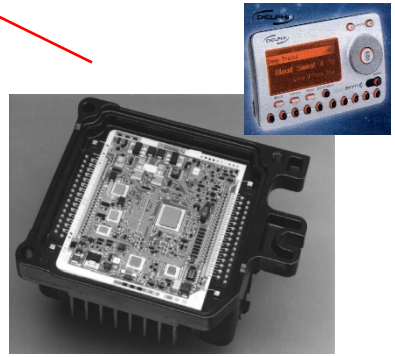






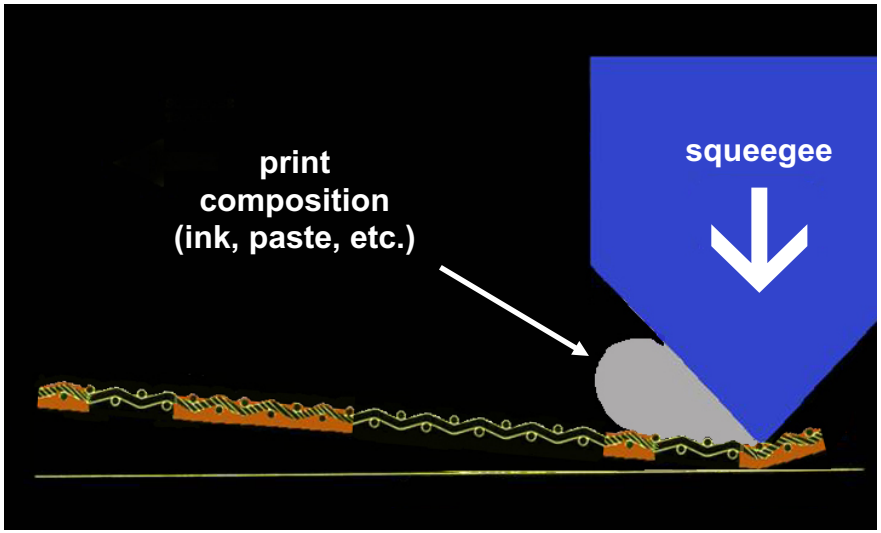


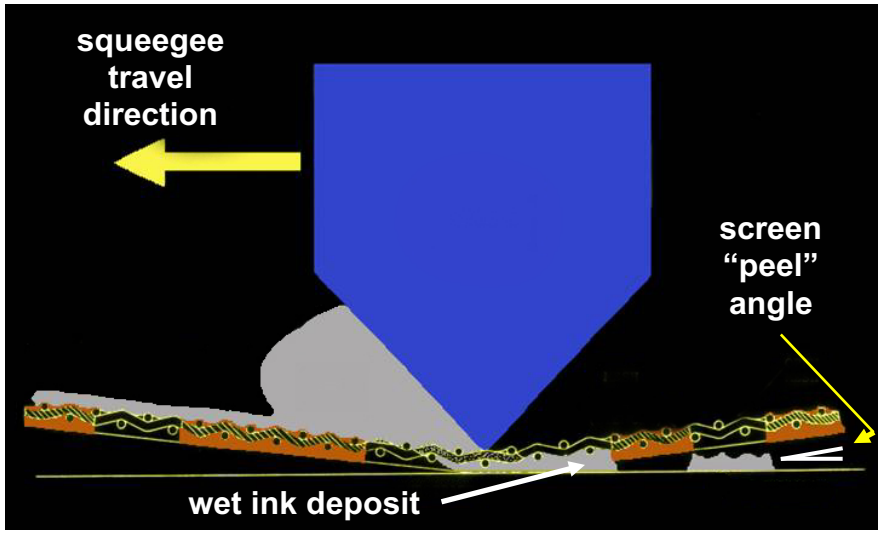




Screen Printing in Printed Electronics

Ink Transfer in Screen Printing





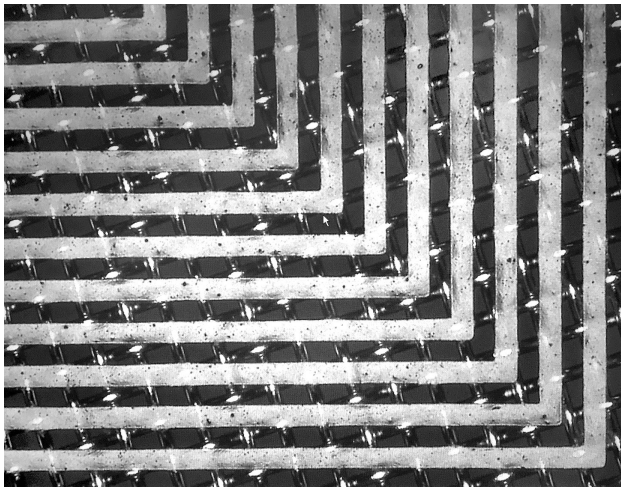
The screen is elevated a specific height above the substrate. The squeegee moves downward, deflecting the screen into a single line of contact with substrate, and then travels laterally. The tension of the elevated screen mesh lifts or “peels” up behind the traveling squeegee, leaving ink in position on substrate.

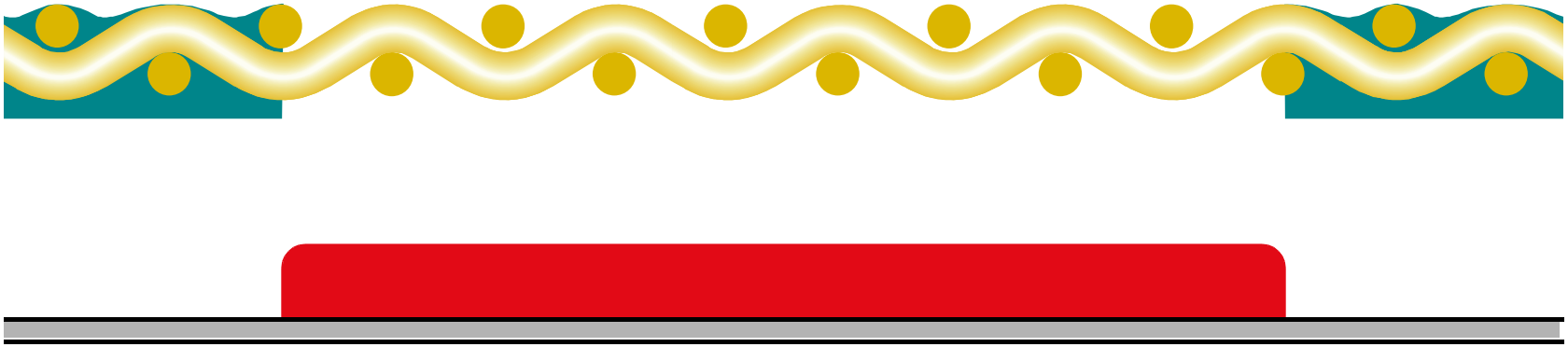
**Screen Printing is the only “contact” printing process that requires the ink to pass thru the printing plate from back to front.*

Screen Making for Printed Electronics

Screen Mesh

- Has Most Control over Ink Deposit
- Supports the image stencil system
- Directly Involved in Ink Transfer
  - *Flexibility to maintain single point of contact*





Screen Making for Printed Electronics

Factors which influence your mesh selection

1) Minimum artwork size requirements
   (smallest lines & spaces)

2) Ink/mesh relationship
   (Can the ink pass thru the chosen mesh?)

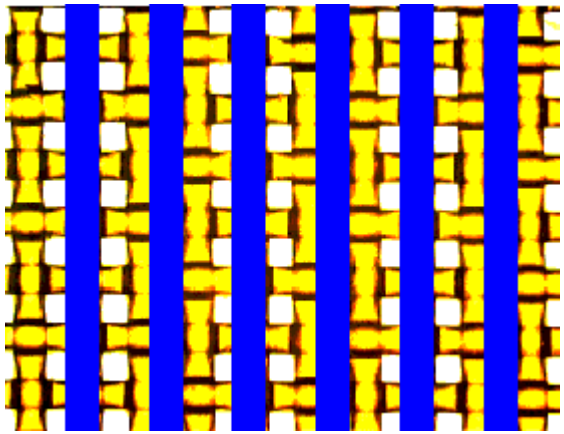
3) Resulting Wet Ink Film Thickness

You have to satisfy all of these requirements

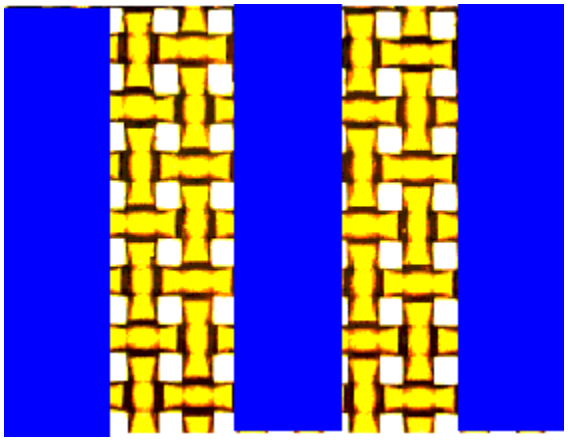
Screen Making for Printed Electronics

Smallest Printable Line Width Calculation

- Narrowest printable line = (2 threads + 2 Mesh Openings)



Too much obstruction



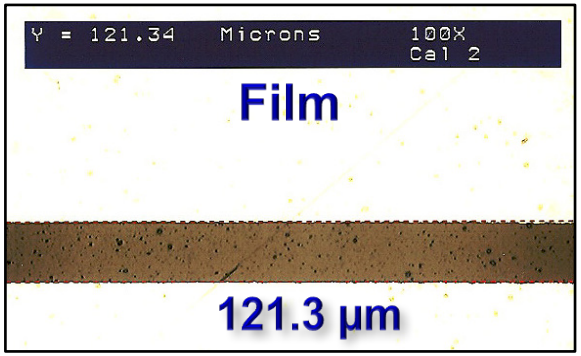
Good

Screen Making for Printed Electronics

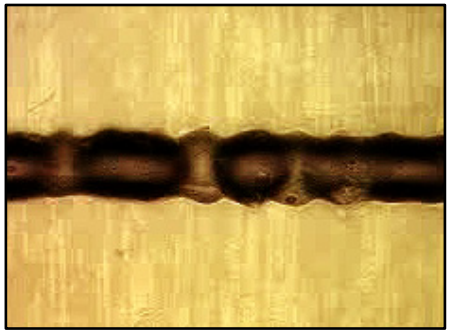
Smallest Printable Line Width Calculation

Narrowest printable line =
(2 threads + 2 Openings)

Ex: 121 Micron Line



255-40 PW



2 Td + 2 Mo = 194 µm

355-34 PW



2 Td + 2 Mo = 130 µm

460-27 PW



2 Td + 2 Mo = 98 µm

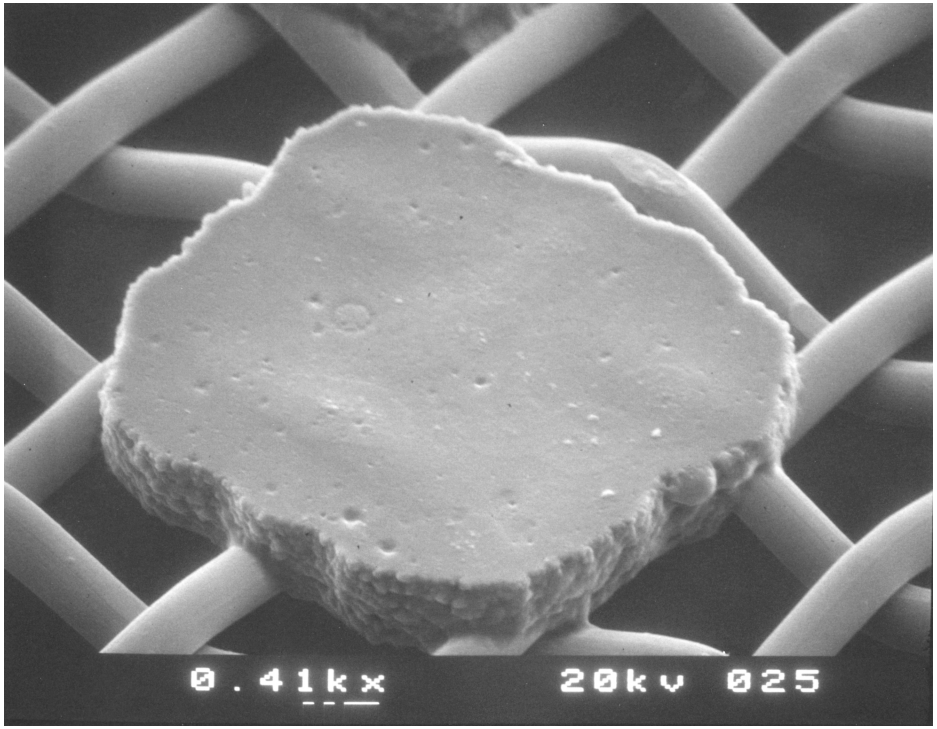
Screen Making for Printed Electronics

Small Via's Need Adequate Mesh Real Estate

Multilayer Dielectric:

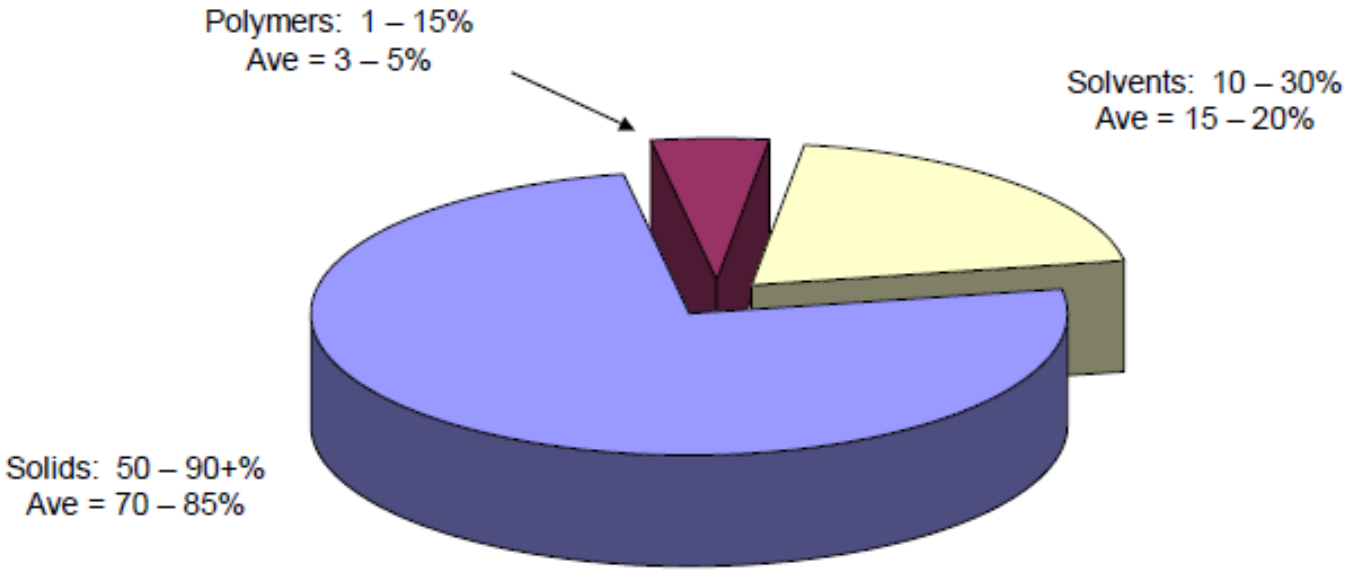
Printing an entire circuit area with an insulating layer of glass composition, and leaving strategic windows or "via's" open and clearly defined.

The screen pattern is almost entirely open, with tiny emulsion islands ("via's") remaining attached to the mesh. There must be sufficient mesh surface available for these via's to maintain good adherence during print life. Three filaments in both directions minimum.



Screen Making for Printed Electronics

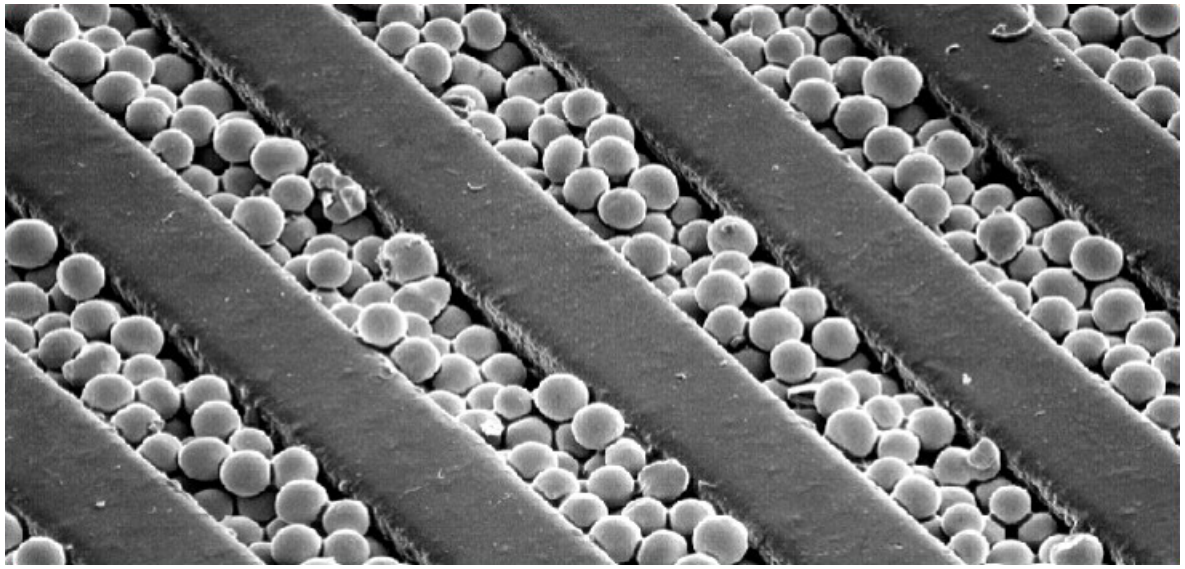
TYPICAL MAKE-UP OF ELECTRONIC MATERIALS (by weight)



Thick Film paste (or "Composition") typically contains about 80% solids

Screen Making for Printed Electronics

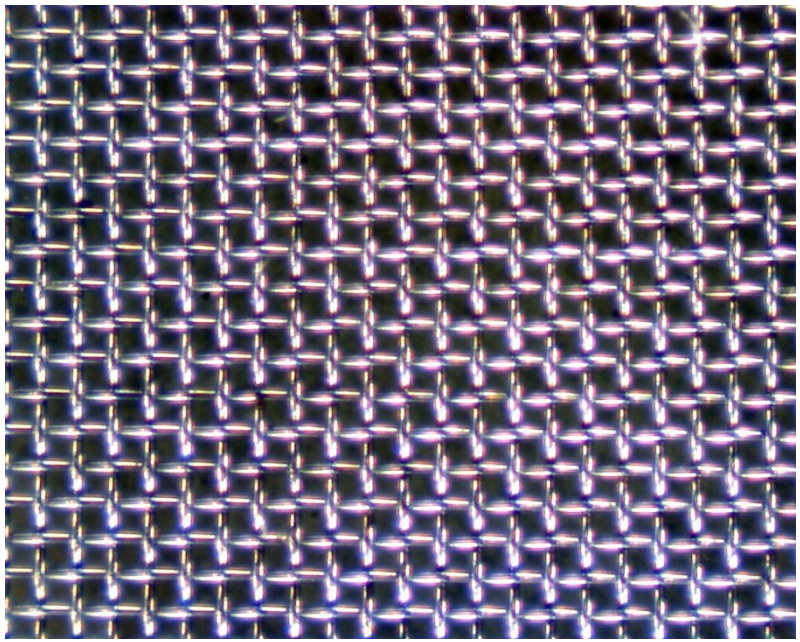
Ink/mesh relationship *(Can the ink pass thru without sifting?)*



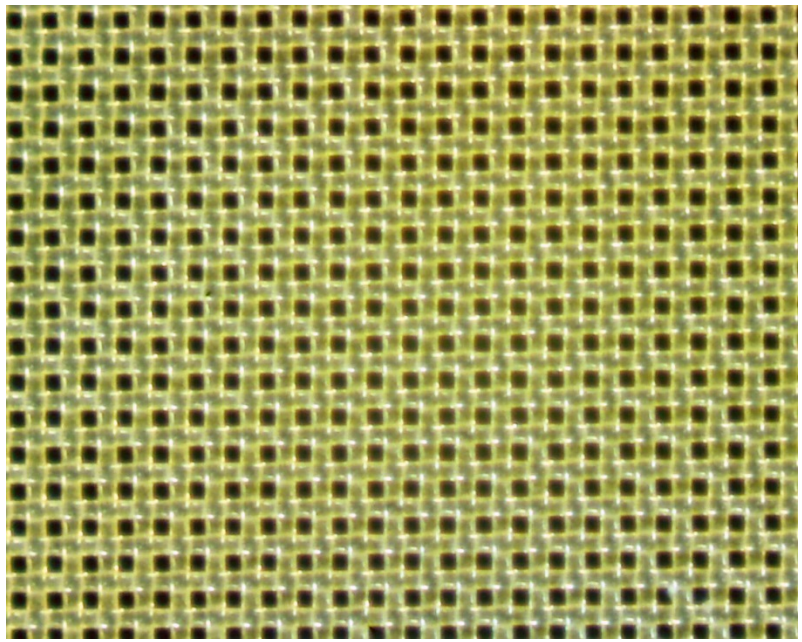
For proper passage and to avoid sifting, the mesh openings should be approximately 4x the size of the largest particle in the paste.

Screen Making for Printed Electronics

Ink/mesh relationship *(Stainless Steel vs PET)*



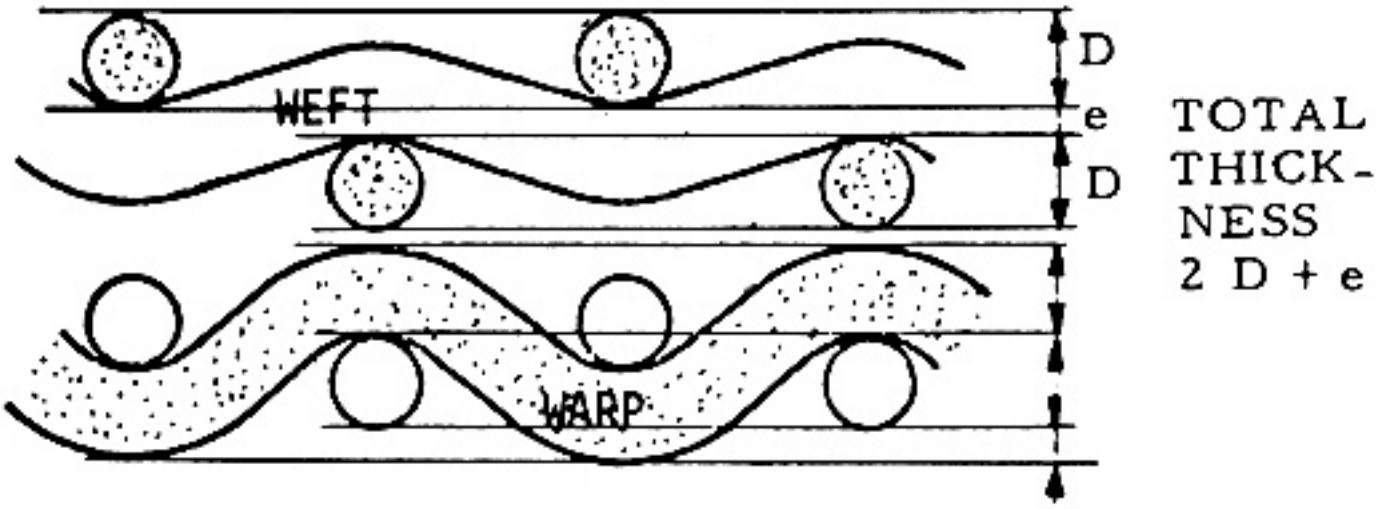
400 Stainless Steel Mesh;
Plain Weave, 18µ wire dia.,
51% open area, 45µ opening
Max particle: 11µ



420 Polyester Mesh;
Plain Weave, 27µ thread dia.,
23% open area, 29µ opening
Max particle: 7µ

Screen Making for Printed Electronics

Depiction of Woven Wire Mesh Thickness



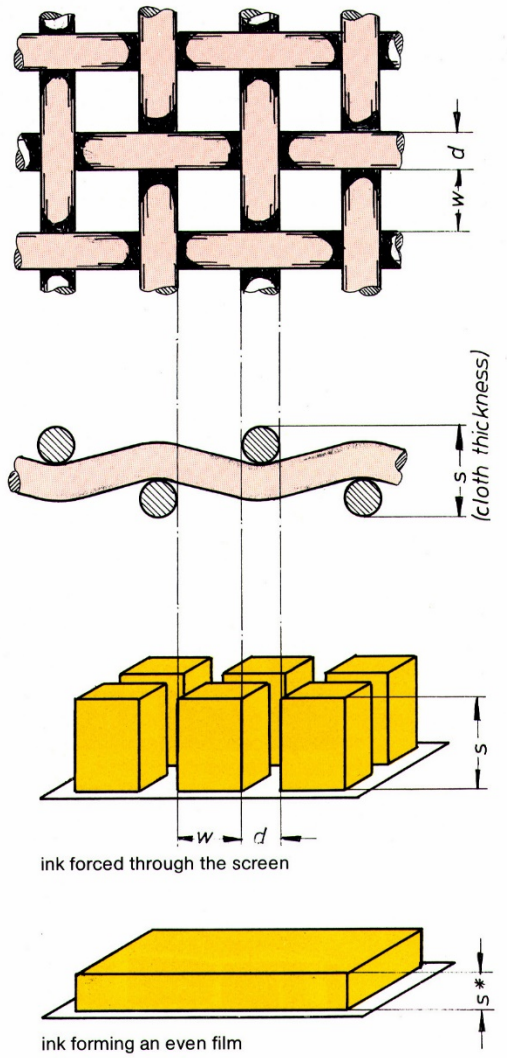
Wire cloth tends to be 0% to 10% more than the theoretical woven thickness value of (2 x diameter), depending on open area %. Additional weave thickness traditionally is in the “warp” direction of the weave.

Screen Making for Printed Electronics

Concept of theoretical screen printed wet ink film thickness (*aka WIFT or TIV*)

WIFT = (Tm x OA)

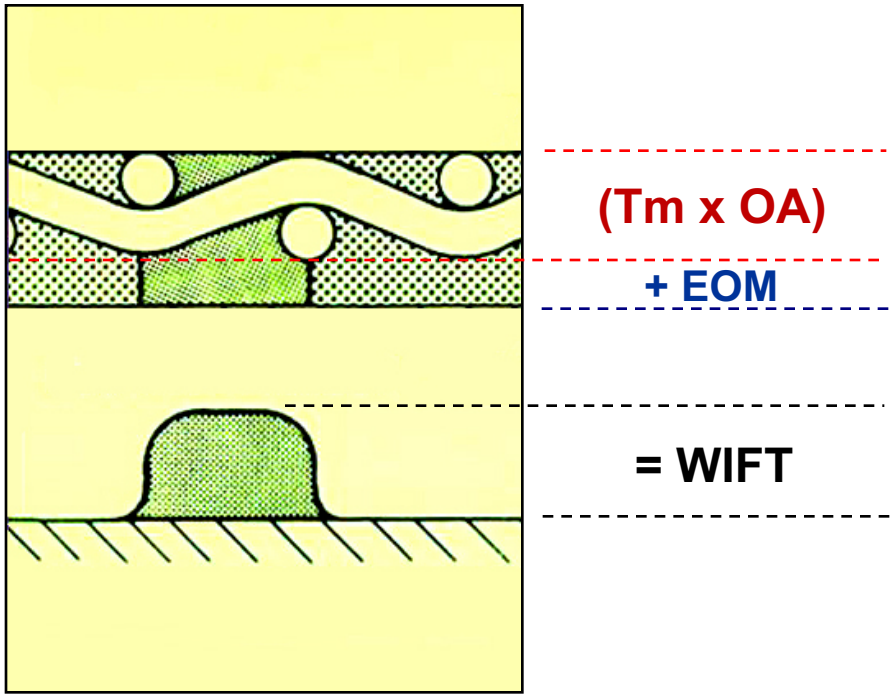
Where:
"Tm" = mesh thickness
"OA" = Open area percentage



Screen Making for Printed Electronics

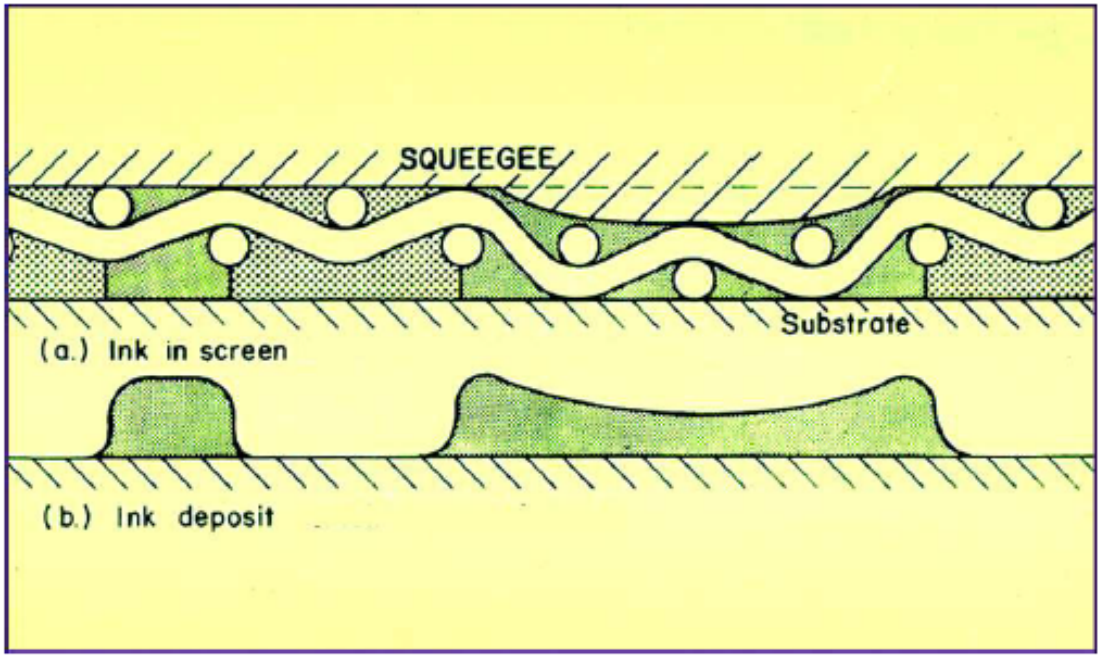
Effect of EOM on wet ink film thickness

WIFT = (Tm x OA) **+ EOM**



Screen Making for Printed Electronics

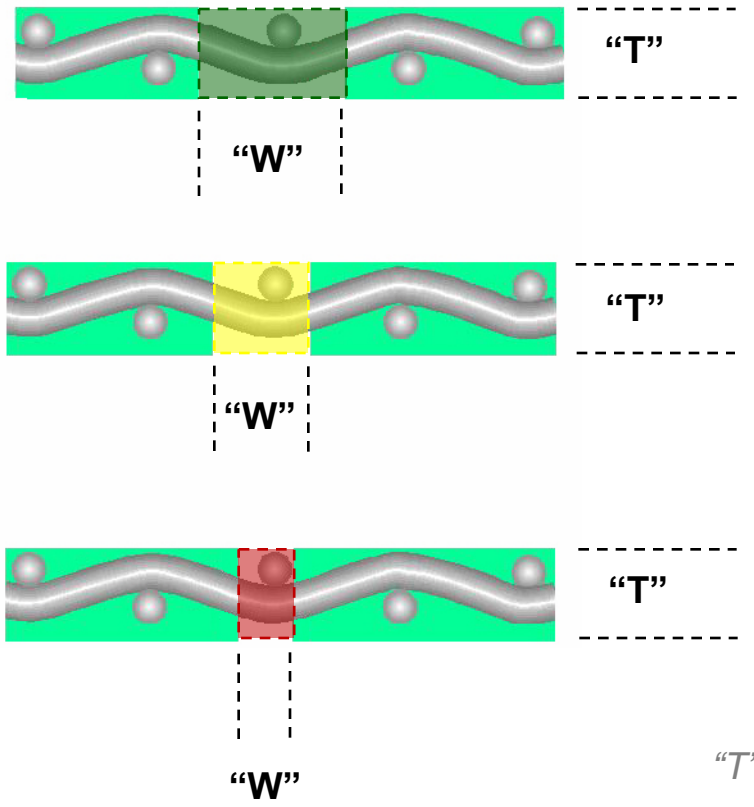
Effect of EOM on wet ink film thickness



Artwork features over 0.075" begin to show this "savaging" effect

Screen Making for Printed Electronics

Printable Line Width vs. Screen Thickness: *"Aspect ratio"*



"W" is greater than "T"
Optimal

"W" = "T"
Practical Limit

"W" is smaller than "T"
Very difficult, if not impossible

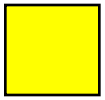
"T" based on total screen thickness (mesh + emulsion thickness)

Screen Making for Printed Electronics

Printable Line Width vs. Screen Thickness: *"Aspect ratio"*



It's easier to print a factory…



…than a house,



or a skyscraper!

Screen Making for Printed Electronics

Summary for mesh selection

a) The mesh type selected must to be able to reproduce the smallest features of the artwork.

b) The ink being used must be able to pass thru the selected mesh type without sifting.

c) The resulting Wet Ink Film Thickness from the screen selected must be appropriate for the application.

Sometimes these things can conflict!