SPIN COATING

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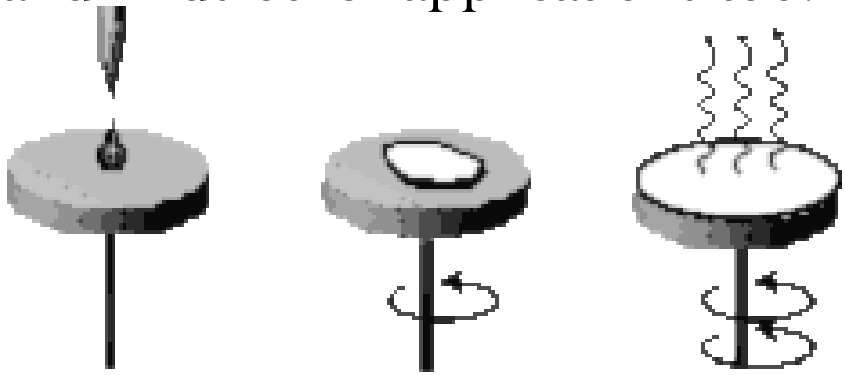
06.05.2017

Introduction

- A process in which solution is spread evenly over a surface using centripetal force.
- Spin coating will result in a relatively uniform thin film of a specific thickness.
- Spin coating is an important way of creating thin films in the microelectronics industry and finds other applications too.

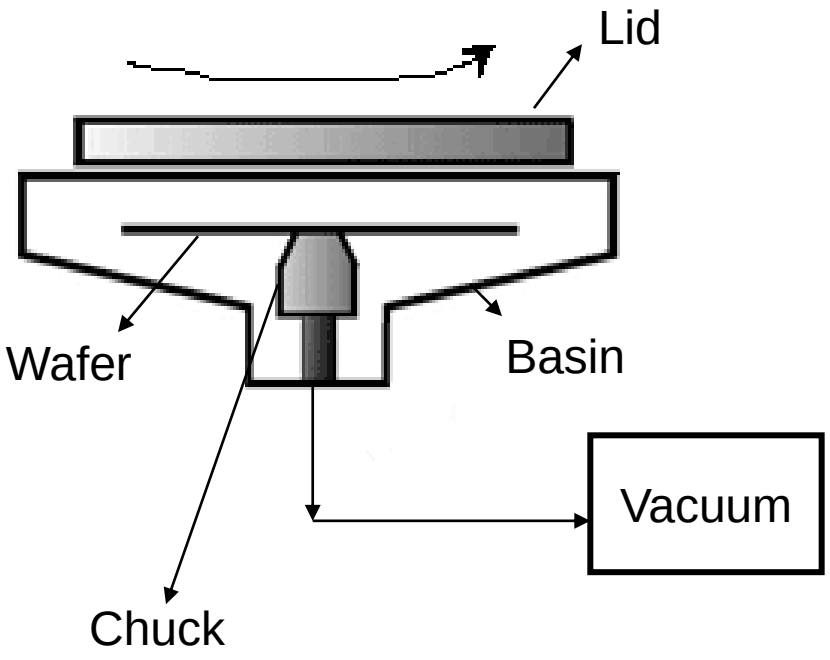


Brief History

- Spin coating was first used to apply coatings of paint and pitch around seventy years ago.
- In 1958 Emslie et. al. developed the first spin coating model.
- This model has been used as a basis for future more specific or complicated models.

Lawrence and Zhou: “Spin Coating of Non-Newtonian Fluids”

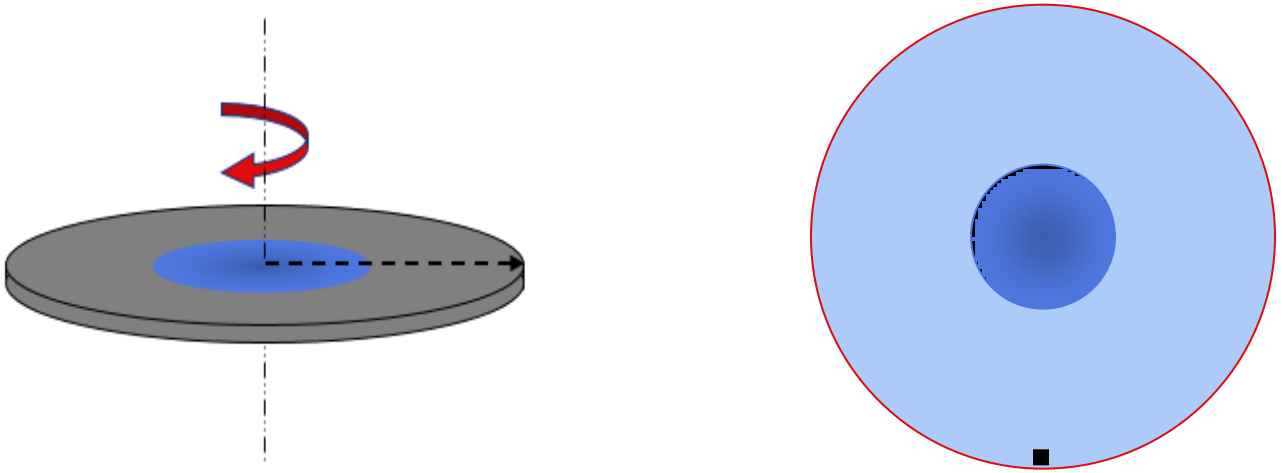
Spin Coater Schematic



- Wafer is held to chuck with vacuum pump.
- Lid is placed over spinning basin before spin is initiated.

Basic Physics of Spin Coating

Centripetal force is responsible for the spread of liquid across the wafer.

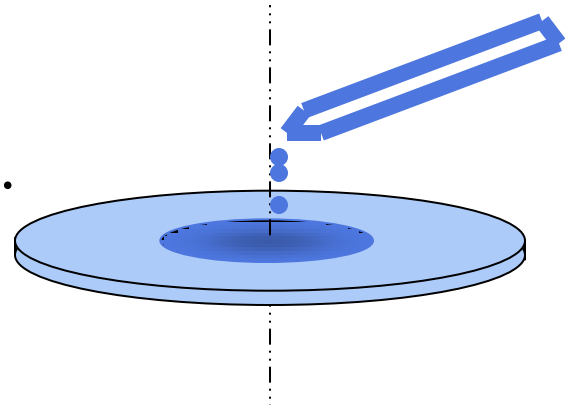


At long times the fluid will flow only negligibly, resulting in a lower limit of the final thickness.

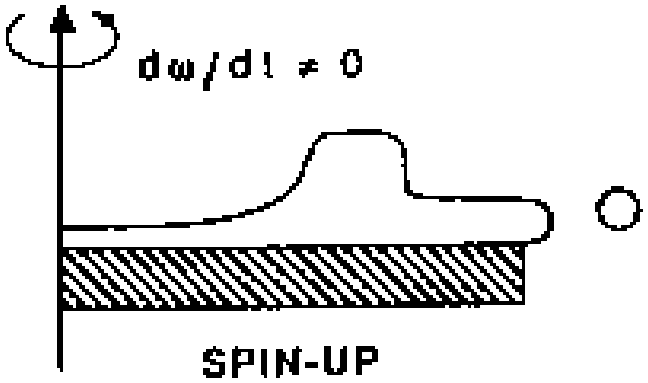
Spin Coating Process

Four main processing steps:

- Step 1: Deposit fluid onto substrate.



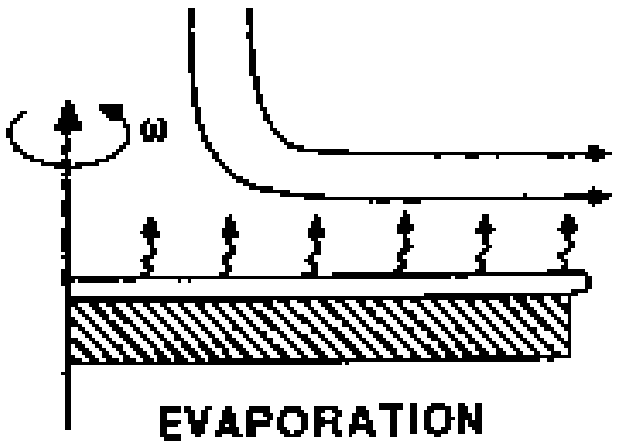
- Step 2: Accelerate wafer to final radial velocity.



http://www.mse.arizona.edu/faculty/birnie/Coatings/

Spin Coating Process

- Four main processing steps:
  - Step 3: The coating thins at a rate that depends on the velocity at which the wafer is spinning and the viscosity of the fluid.
  - Step 4: Solvent is evaporated from the film, resulting in further thinning.



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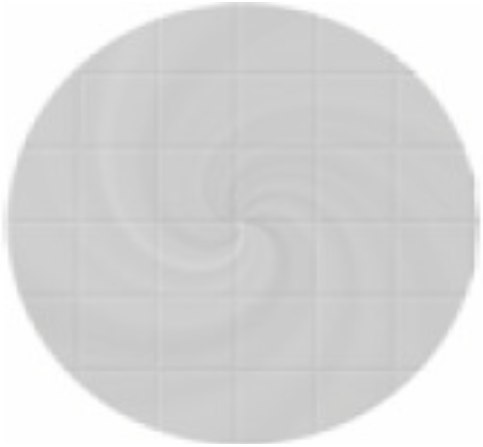
Common Spin Coating Defects

- Bubbles on the surface of the coated wafer.
- This occurs when fluid is deposited as the wafer is spinning, and may be caused by a faulty dispense tip.

- A swirling pattern may be observed.
- Causes:
  - Fluid deposited off center
  - Acceleration too high
  - Spin time to short
  - Exhaust rate too high



http://www.cise.columbia.edu/clean/process/spintheory.pdf

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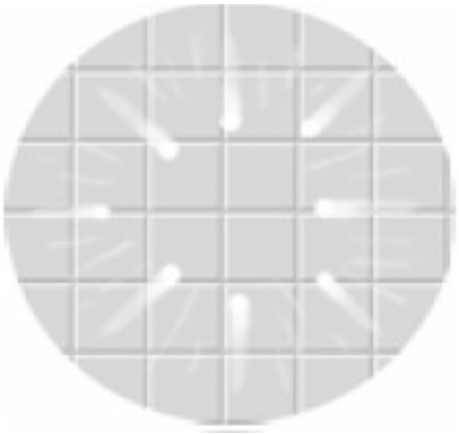
- A mark or circle in the center of the wafer could indicate a chuck mark.
- If a chuck mark occurs the type of chuck should be changed.

Streaks can occur on the wafer for a number of reasons including:

- Acceleration too high
- Fluid deposited off center
- Particles on surface prior to spin



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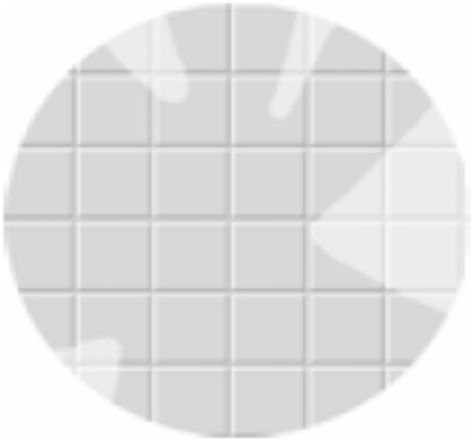
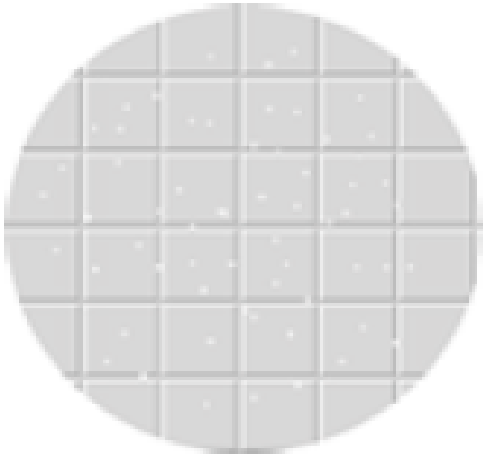


- Uncoated areas on wafer occur when to little fluid is deposited on the wafer.

Pinhole defects can be caused by:

- Air bubbles
- Particles in fluid
- Particles on substrate.



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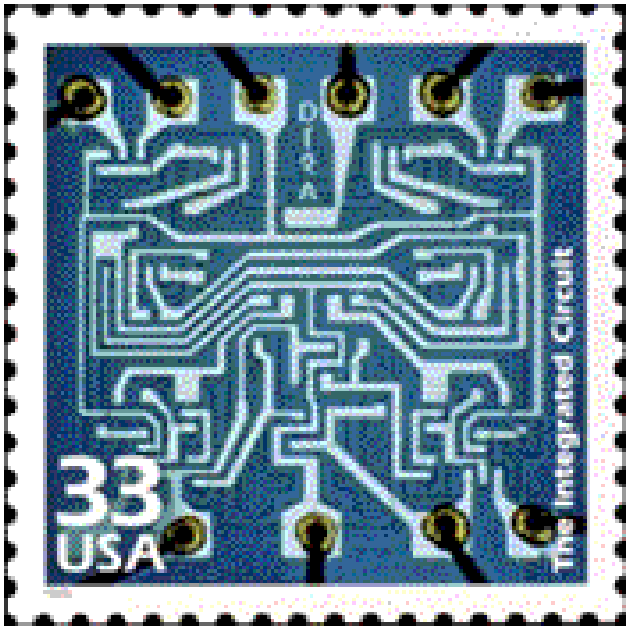
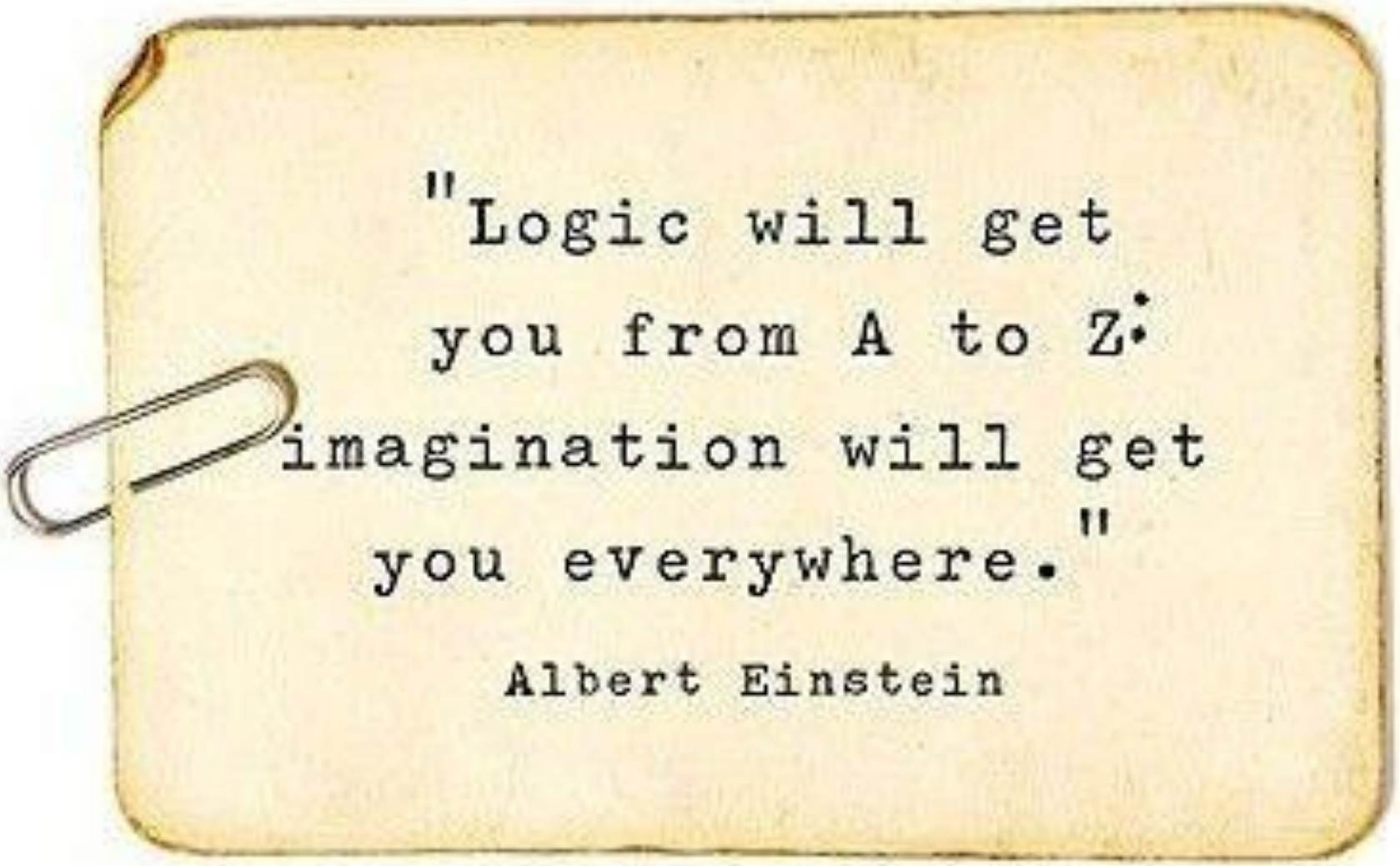
Industrial Uses of Spin Coating

- Photoresist for patterning wafers in microcircuit production
- Insulating layers for microcircuit fabrication such as polymers
- Flat screen display coatings
- Antireflection coatings
- DVD and CD ROM
- Television tube
- Antireflection coatings




"Logic will get
you from A to Z;
imagination will get
you everywhere."
Albert Einstein

Thank You