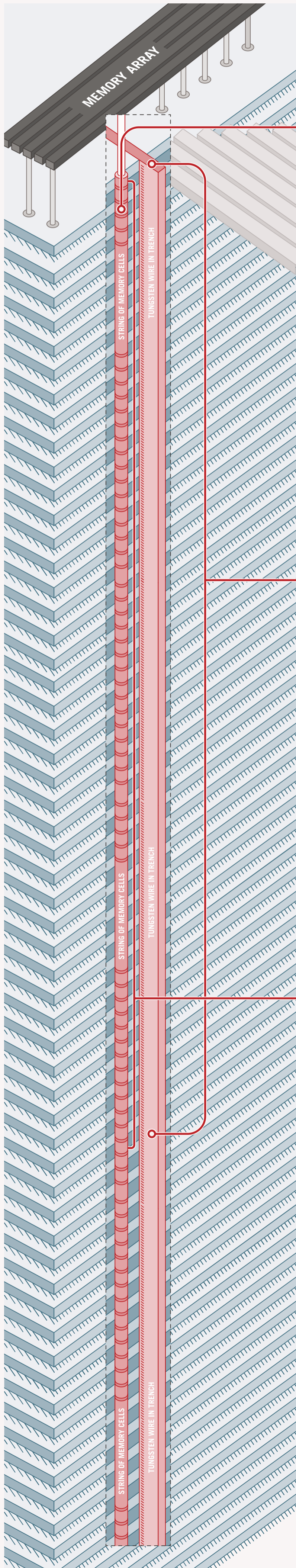


Entegris Solutions for the Unique Challenges of 3D NAND Design and Manufacturing

Three-dimensional vertically-stacked memory architectures offer exponential gains in flash memory storage, but they also introduce fundamental new challenges at the device fabrication and integration level. These challenges affect all aspects of the flash memory product chain, from design to supply to material handling, manufacturing, and delivery. These challenges become more acute as architectures are pushed from 64 vertical layers to 96, 128, and beyond.

Entegris understands many of these challenges and has ideal solutions for them.

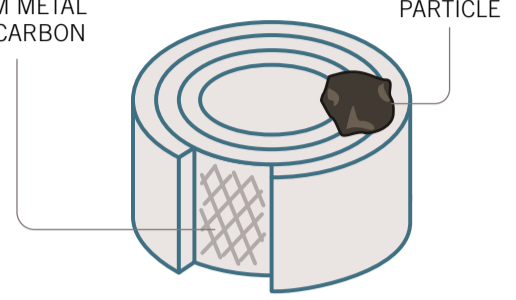


CHALLENGE:

Purity and performance of materials

MEMORY CELL

CONTAMINATION FROM METAL AND CARBON



Carbon and metal must be avoided in the film. Contamination in a single layer can kill a whole storage string.

ENTEGRIS SOLUTIONS:

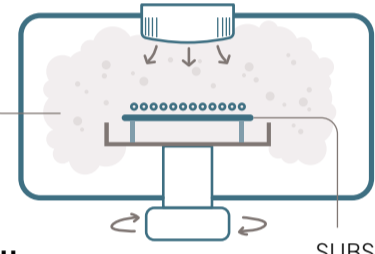
- C-free ALD precursors
- Contamination-free solid precursor delivery
- Specialized filters and purifiers

CHALLENGE:

Consistency at top and bottom of deep vertical holes and trenches

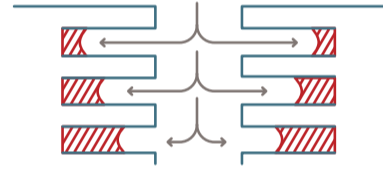
ATOMIC LAYER DEPOSITION

PRECURSOR GAS



WET ETCH

SUBSTRATE



Extreme vertical architectures introduce differences in the reaction environment for cells at the top and bottom of the stack.

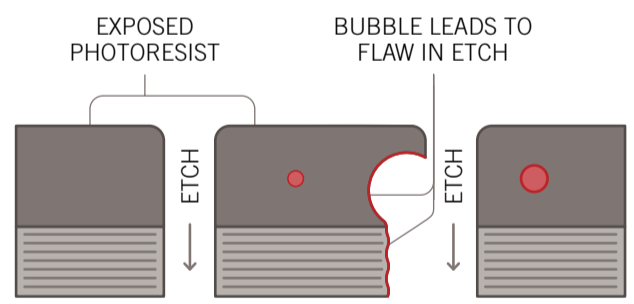
ENTEGRIS SOLUTIONS:

- Formulated chemistries for selective Si_3N_4 removal
- C-free ALD precursors

CHALLENGE:

High-viscosity photoresist handling required for small channel diameters

DRY ETCH DEFECT



Dispensing high-viscosity photoresist accurately without bubbles or contamination requires a specialized solution.

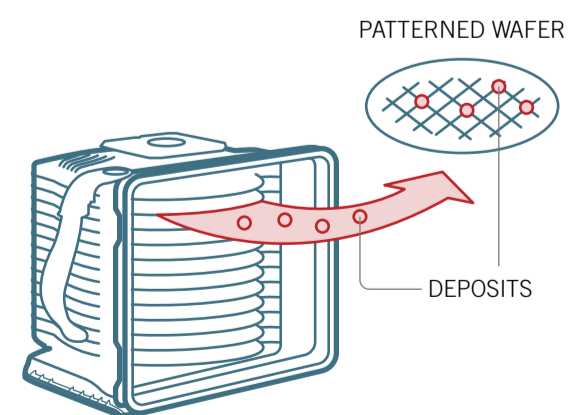
ENTEGRIS SOLUTIONS:

- IntelliGen® two-stage pump and Impact® filter
- Liner-based photoresist dispense

CHALLENGE:

Avoiding queue-time defects from FOUP by-product adsorption

FOUP



Extreme high aspect ratio etches create high volumes of by-product that could be released later from a FOUP body to the wafer, causing a defect.

ENTEGRIS SOLUTION:

- Entegris Barrier Material (EBM) FOUP with diffuser purge