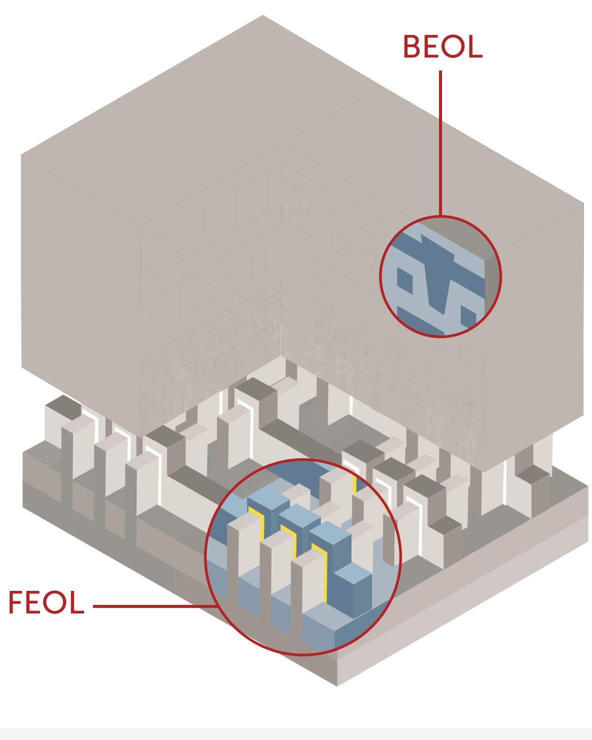
Entegris' Holistic Approach to Enabling Device Performance, Yield, and Reliability

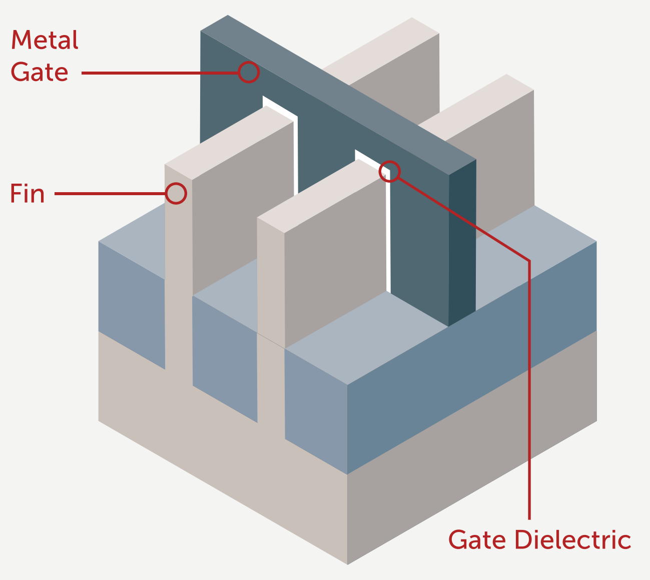


As performance demands increase, logic device architecture is getting smaller and more complex. In the front end of line (FEOL), transistors are moving to non-planar 3D structures. In the back end of line (BEOL) metal line widths and pitch are shrinking. New choices in materials and processes are required to ensure device performance while improving yield and controlling costs. Each innovation yields new challenges and considerations downstream.

A holistic approach is needed.

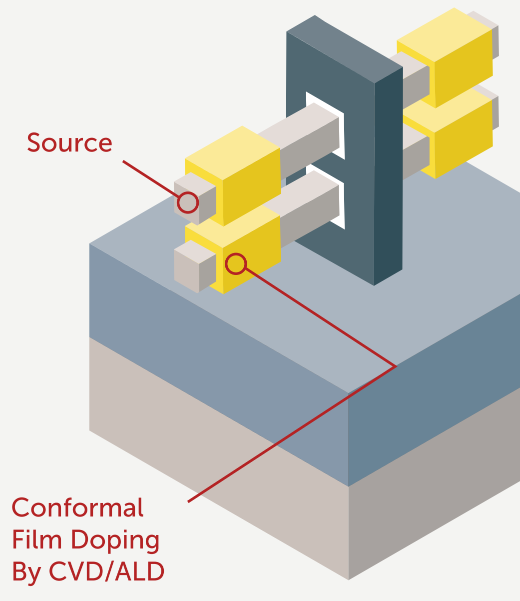
FEOL: NEW ARCHITECTURES AND MATERIALS

New architectures are being explored to enable transistor performance factors, which leads to new material considerations. Additionally, the intrinsic carrier mobility within the transistor must be improved using new channel materials such as silicon-germanium (SiGe) and germanium (Ge), which require new surface cleans, etch chemicals, and new high-k/channel interface layers.



FinFET

Vertical fins with gates that wrap around them allow better control of the transistor (lower leakage) and provide more surface area for higher drive currents (speed).

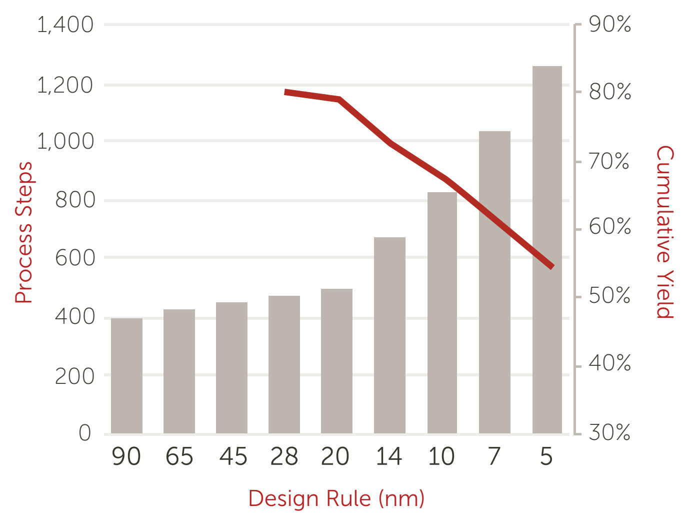


Gate-All-Around (GAA)

Nanowires with gate all around (GAA) architecture provide even more leakage control and faster switching speeds.

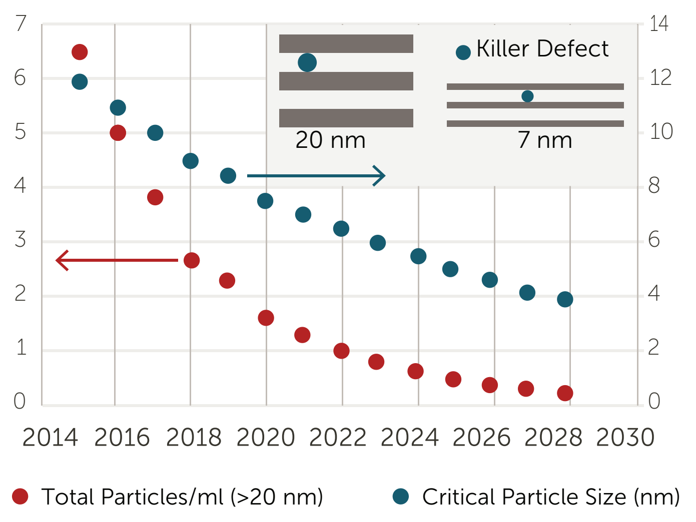
CLEANER MATERIALS ARE KEY

As the number of process steps increase, cumulative yield drops significantly.



Source: KLA Tencor

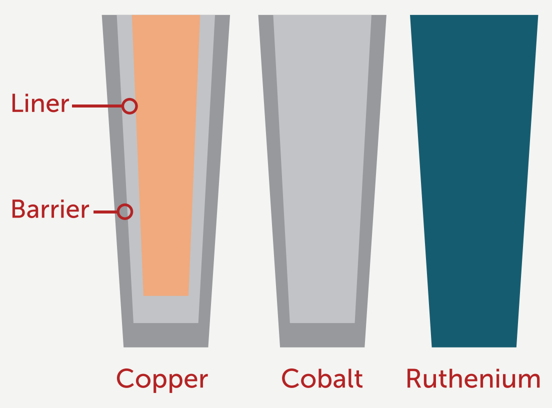
As critical defect size decreases to below 10 nm, the total acceptable particle count also decreases.



Source: 2015 ITRS 2.0 Roadmap

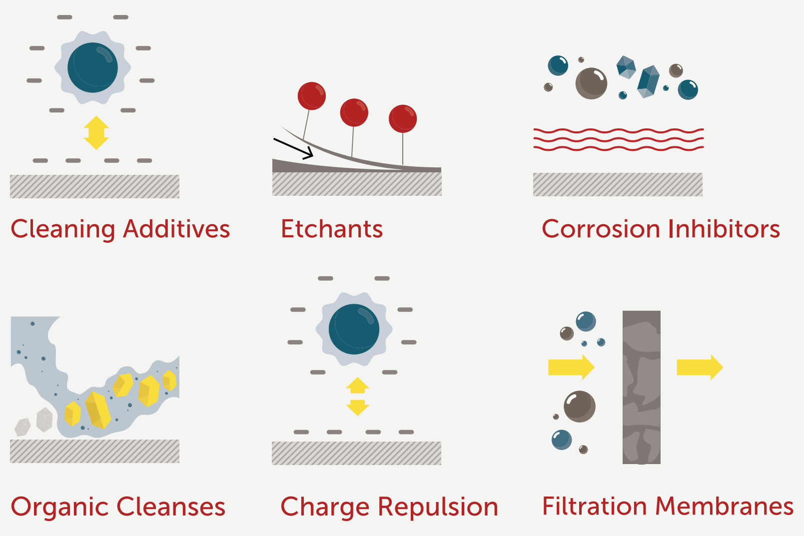
BEOL: NEW METALLURGIES AND PROCESSES

As dimensions get smaller, the conductivity and reliability of traditional materials like tungsten (W) and copper (Cu) are no longer sufficient to enable performance and reliability.



New Metallurgies

New metallurgies like cobalt (Co), ruthenium (Ru), and molybdenum (Mo) are being explored to improve conductivity and reliability by enabling thinner liner/barrier films.

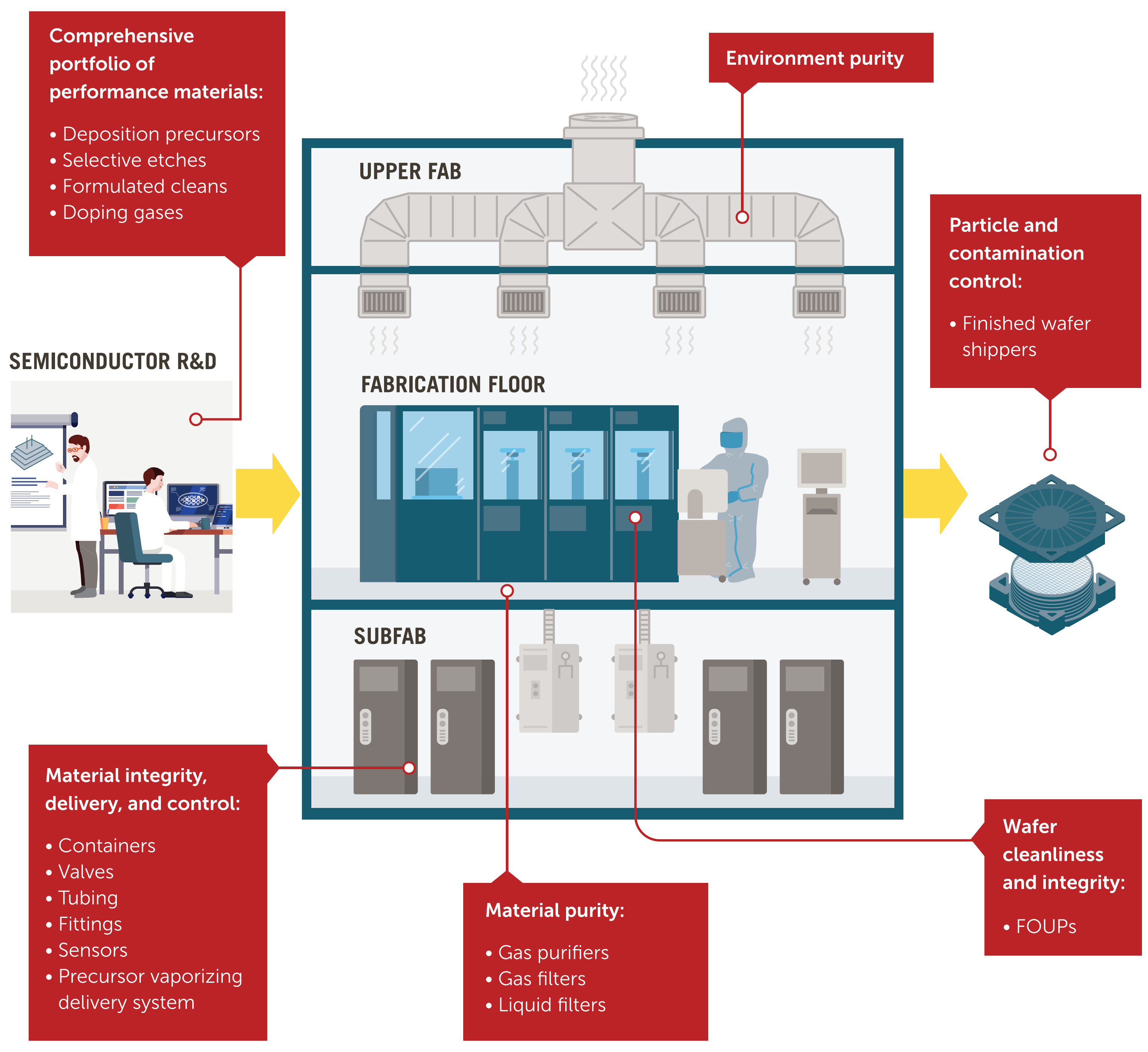


New Cleans

New metals require new chemical cleaning formulations be developed. For example, ensuring effective surface cleaning after metal CMP requires a formulation that removes slurry debris without attacking critical metal surfaces.

ENTEGRIS HOLISTIC SOLUTIONS FOR THE ENTIRE ECOSYSTEM

Only Entegris has the breadth of solutions and depth of industry expertise to enable our customers to transform radical ideas into modern technology.



Comprehensive portfolio of performance materials:
- Deposition precursors
- Selective etches
- Formulated cleans
- Doping gases

Environment purity

Particle and contamination control:
- Finished wafer shippers

Material integrity, delivery, and control:
- Containers
- Valves
- Tubing
- Fittings
- Sensors
- Precursor vaporizing delivery system

Material purity:
- Gas purifiers
- Gas filters
- Liquid filters

Wafer cleanliness and integrity:
- FOUPs

Whether it is new metallurgy precursors, effective delivery systems, new cleaning formulations, or new filtration membranes, Entegris offers a holistic solution to your most advanced integration challenges, impacting processes across the fabrication floor.

Learn More

www.entegris.com/holistic