

CO₂ Applications in Semiconductor Industry

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*Making Our Planet
More Productive*

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Advantages of CO₂

General

- **Safe & environmentally benign compound**
- **Advantageous chemical & physical properties for micro-structure applications**
- **Minimal waste generation/disposal**
- **Readily available in all semiconductor producing regions of the world.**

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- **Strong global CO₂ supply position**
- **Application know-how**

Current CO₂ Applications

Dry ice blasting for

- **Semiconductor process tool parts cleaning**

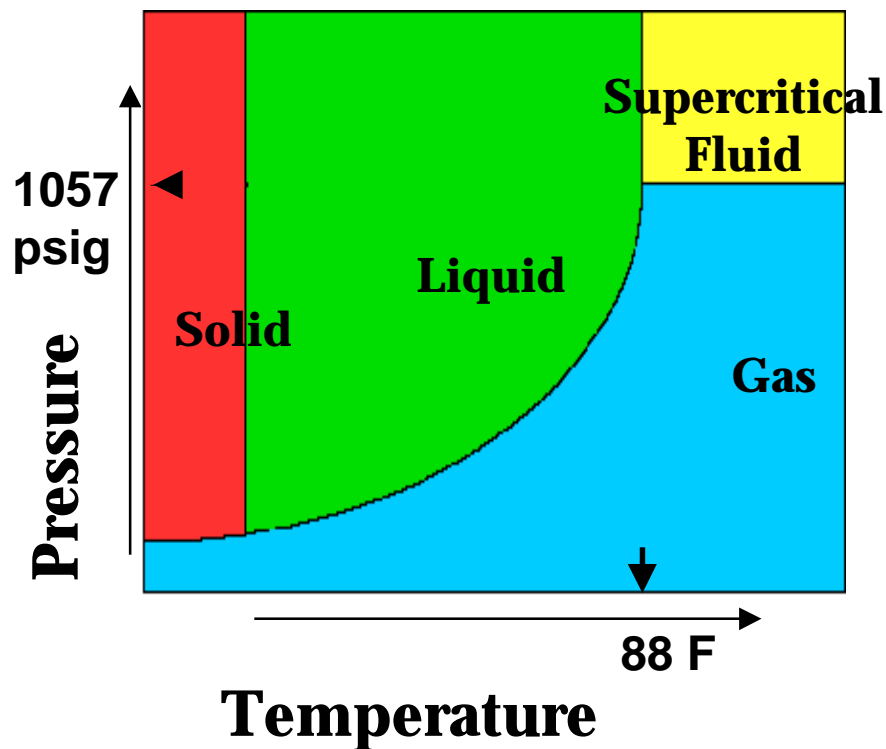
CO₂ snow jet for

- **Semiconductor process tool parts cleaning**
- **Wafer cleaning (e.g., veil removal, etc.)**

Supercritical CO₂ (SCCO₂) or dense phase CO₂ for

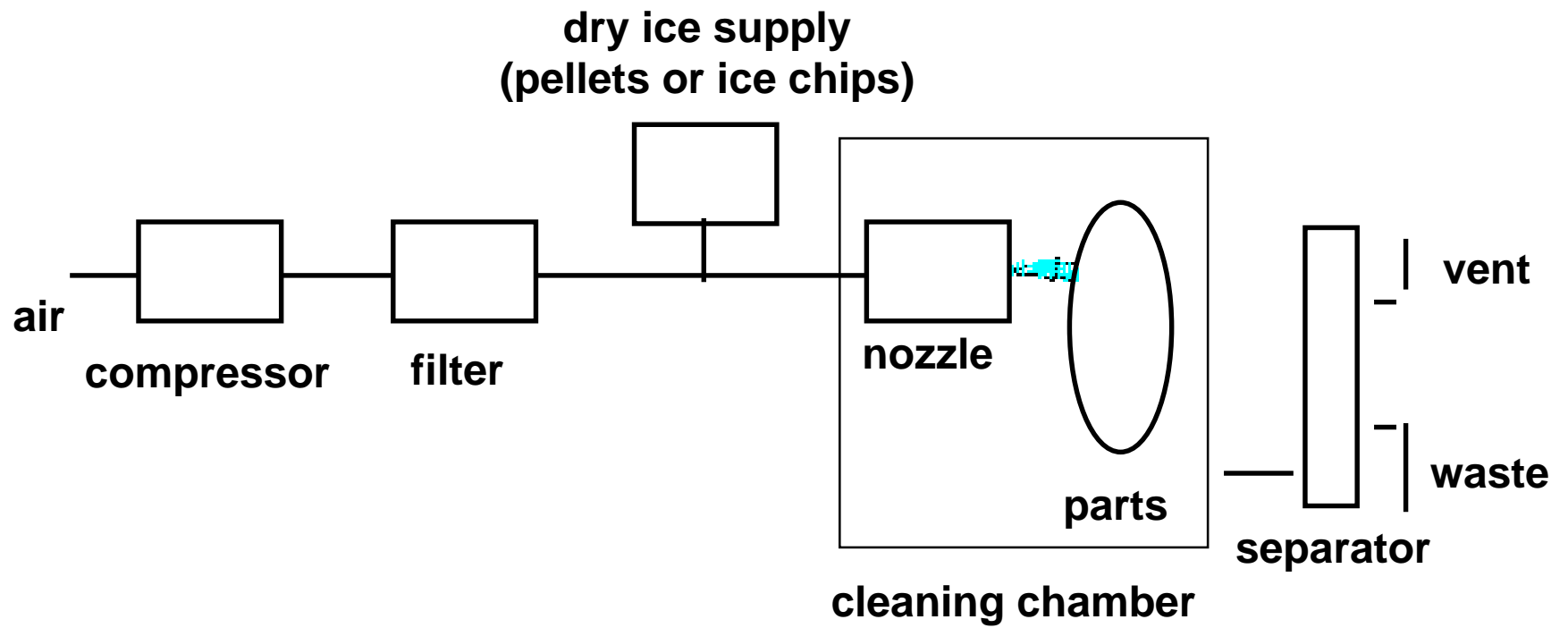
- **Wafer cleaning (photoresist stripping)**
- **Wafer drying**
- **Advanced photoresist applications**

Supercritical Carbon Dioxide (SCCO₂)

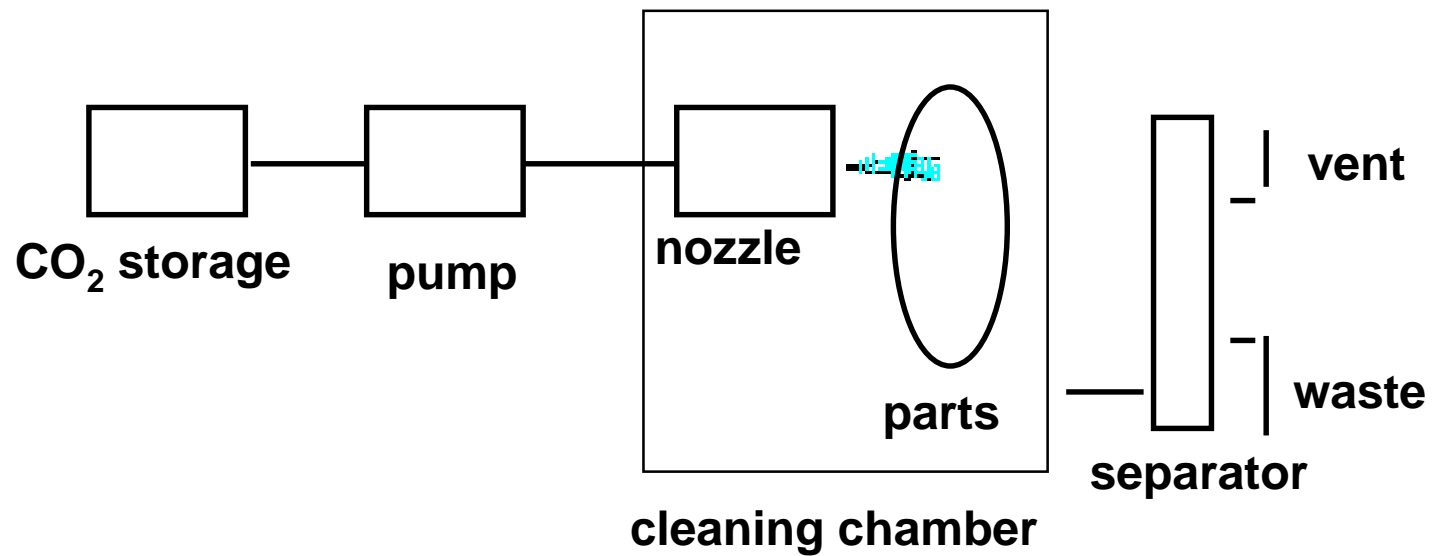


- A distinct phase with unique physical and thermodynamic properties.
- Occurs only if $T > 88\text{ F}$ and $P > 1057\text{ psig}$.
- Unlike a gas, SCCO₂ is a good solvent.
- Unlike a liquid, SCCO₂ can be easily cleaned of contaminants and recycled.

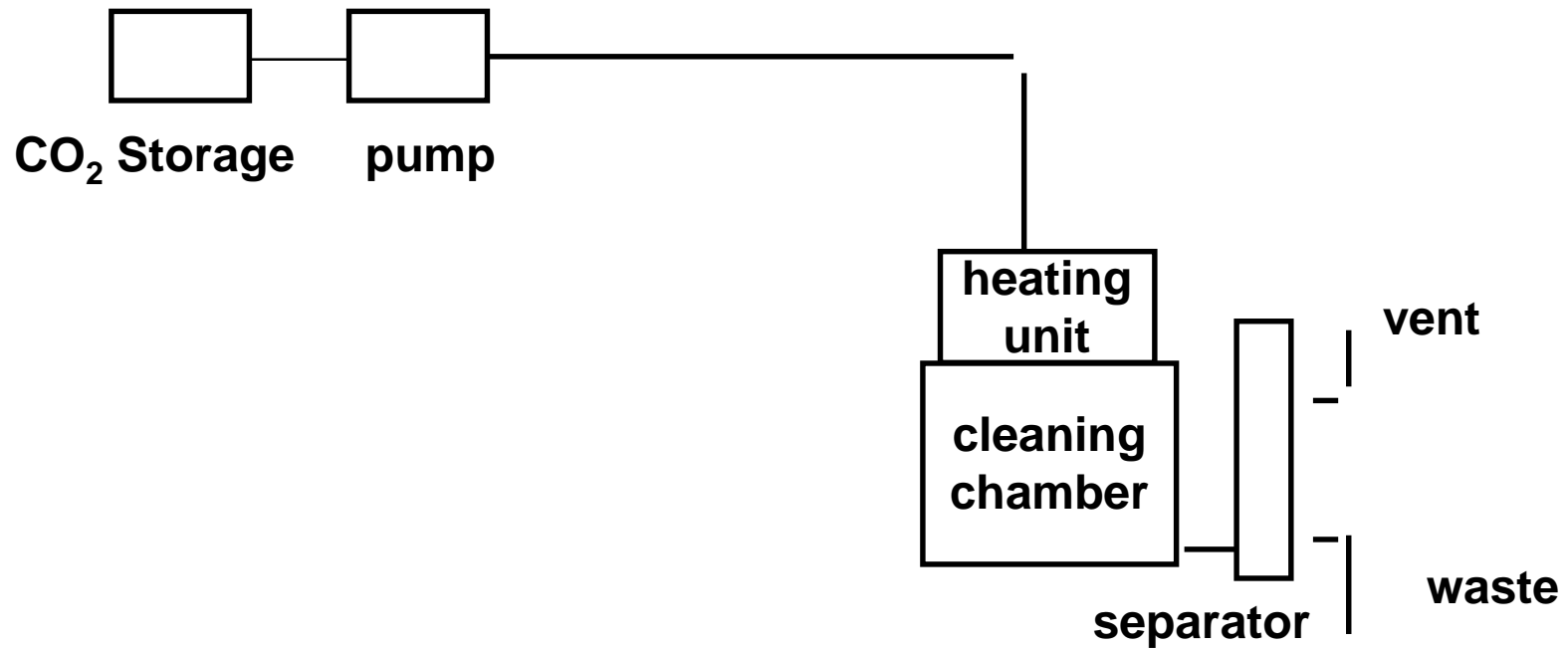
Dry Ice Blasting



CO₂ Snow Jet



Supercritical CO₂ (SCCO₂)



Environmental Issues of CO₂

- CO₂ is a greenhouse gas suspected to contribute to global warming.
- Virtually all commercial CO₂ is captured by-products from industrial sources.
- The use of CO₂ does not result in additional greenhouse gas emission.

Issues With CO₂ In The Fab

- High pressures
- Asphyxiation potential
- Low temperature
- For detailed information, refer to the Praxair Material Safety Data Sheet, Number P-4573, “Carbon Dioxide, Refrigerated Liquid.”
Call 800-PRAXAIR.

Need for Efficient Industry Transfer

- Development times for 157nm photoresist applications are short.
- Concurrent involvement of suppliers in SCCO₂ photoresist research would maximize rate of technology transfer.