

PICO-TRAP™ AHM

ULTRA-PURIFICATION SYSTEM FOR PECVD OF AMORPHOUS CARBON FILMS

PICO-TRAP™ Patent 7,314,506, issued January 1, 2008

Market Requirements

Reducing the critical dimensions of integrated circuit features is an important problem arising from the continual need to increase functionality of integrated circuits. Leading edge companies require rapid time to market and many new materials are being employed to address the reduction in feature sizes, while not foregoing performance of the final device products.

Ashable hard mask (AHM) or amorphous carbon films have been advantageously employed as a result of their unique combination of physical (hardness) and chemical (easily removed) properties. The film properties have been optimized by the careful selection of the structure and purity of the chemical precursors with Acetylene (C_2H_2) being selected as one of the leading edge materials.

C_2H_2 has many commercial purposes, but as a precursor to the Semiconductor Industry, more stringent purity specifications are required. Purification with Matheson's PICO-TRAP™ AHM has enabled C_2H_2 use in amorphous carbon PECVD processing in high volume manufacturing.

Solvents

Due to the reactivity of the carbon-to-carbon triple bond, C_2H_2 is shipped dissolved in solvents and stored contained in a metal cylinder with porous filling, which renders it safe to transport and use. The PICO-TRAP™ AHM separates C_2H_2 from its solvents allowing high quality amorphous carbon films to be deposited with no process variations resulting from the precursor supply.

The PICO-TRAP™ AHM is fully automated and continuously removes solvents through sub-cooling in incoming C_2H_2 allowing for constant supply and processing ability. Optimizing the control of solvents allows for higher wafer throughput due to fewer cylinder changes. Over 90% of the C_2H_2 cylinder can be used with a higher deposition rate. These benefits reduce the overall cost per wafer pass for the end users and streamline the process by completely eliminating varying incoming gas purity conditions.

In addition to this application there are many other gases that can benefit from the PICO-TRAP™ technology. A complete list is available on request.



PICO-TRAP™ AHM System

- PICO-TRAP™ canister
- PLC based control system
- Manual and pneumatic valves to control gas flow
- Vacuum venturi module
- Continuous operation liquid drain
- Exhausted all metal gas cabinet
- Graphical user interface
- Refrigerant system for thermal regulation

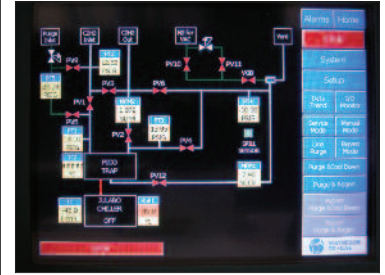


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PLC Based Control System with Color Touch Screen

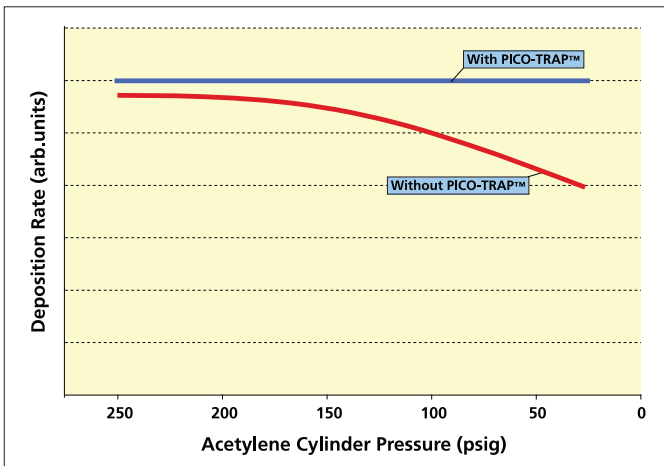
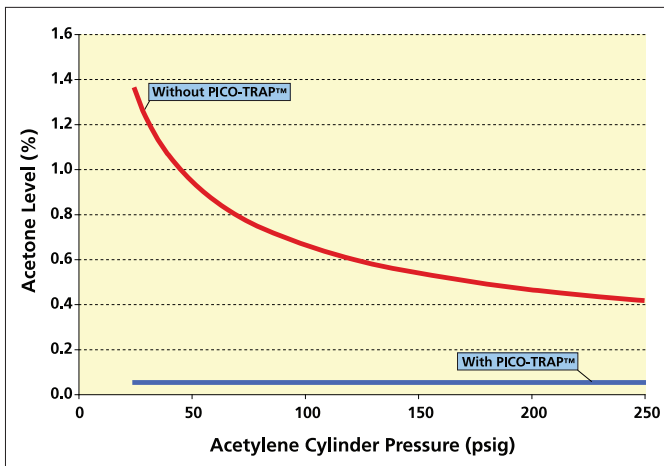
The control system of the PICO-TRAP™ AHM System consists of a PLC based controller cabinet with a pneumatic solenoid bank to sequence process valves as required. The 8 inch full color graphical interface indicates the current program status being executed and provides the user with prompts where manual intervention in required.

The retractable tilt screen mechanism is ergonomically designed and meets SEMI S8 standards for operator interface requirements. Located under the self-closing safety glass window, the touch screen panel displays the state of pneumatic valves, pressure signals, chiller I/O and any active alarms included C₂H₂ flow.



PICO-TRAP™ AHM Performance

Acetone concentrations are maintained at 500 ppm from 0-12 splm of C₂H₂ flow

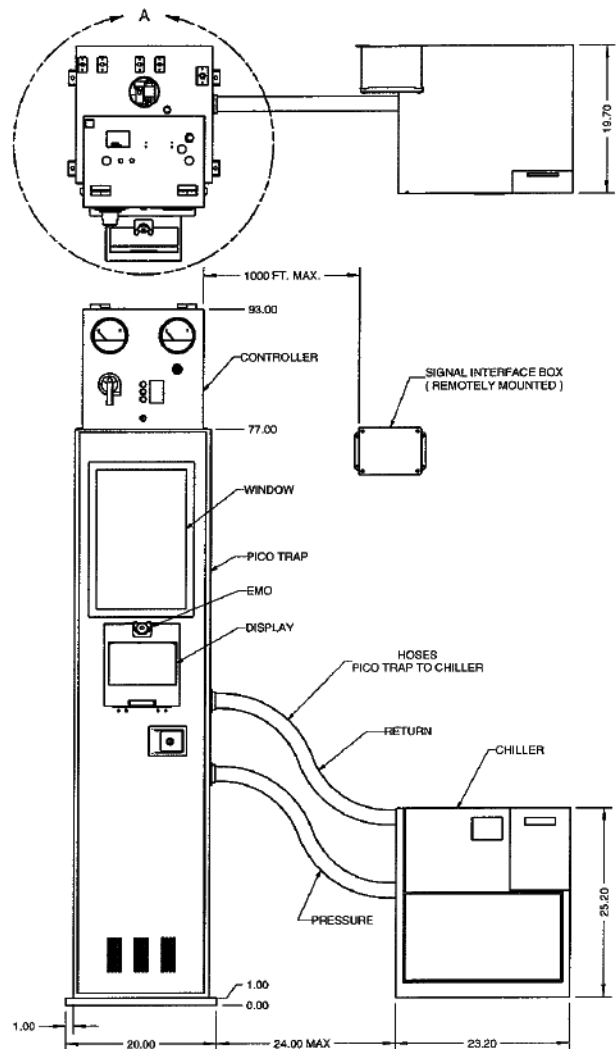


Acetone removed continuously and deposition rate maintained throughout the C₂H₂ cylinder use

PICO-TRAP™ AHM Specifications

- Acetone removed to 500 ppm ±100 ppm
- C₂H₂ cylinder pressure ranges between 280 psig and 50 psig
- C₂H₂ flow up to 14 splm
- Operating Pressure ±1 psig
- Operating Temperature ±1°C

Specifications are subject to change. Please check www.mathesontrigas.com for most current information. MATHESON TRI-GAS is a registered trademark of Matheson Tri-Gas Inc. PICO-TRAP is a trademark of Matheson Tri-Gas Inc.



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