TORONTECH

THERMAL EVAPORATION SYSTEM

Thermal Evaporation System - ToronTES™ 1000

ToronTES™ 1000 is a fully automated thermal evaporation system with a 2×2 channel co-evaporation configuration for sequential and simultaneous multilayer thin film deposition. Four thermal evaporation sources with 12V to 200A power supply deliver voltage-current power display for precise evaporation control. The SS304 prismatic or cylindrical chamber (30 to 60 cm box size) reaches 10^{-7} Torr base pressure and 10^{-6} Torr working vacuum in 30 minutes. A 1.5-hour cycle and touch screen control support multiple daily deposition runs.

A dual-channel thickness controller with 1 to 4 QCMs at 0.1 Å/s and averaged-value output tracks deposition rate across co-evaporation sources. Mass flow meter controlled gas inputs with isolation valves support Ar and N_2 chamber backfill, with an optional RF plasma cleaning unit for in-situ substrate surface preparation. The isolation valve maintains chamber vacuum between experiments, and fully automated layer-by-layer deposition controls each coating sequence. Automatic closed-loop water cooling and 120 °C internal baking support system operation between runs.

An optional 50 to 600 °C PID substrate heater with 2 to 30 rpm rotation accommodates heated deposition onto a wide range of substrate configurations. The turbomolecular and mechanical pump combination, with cryo and dry pump options, provides the high pumping speed needed for the 30-minute pump-down cycle. The 75×120 cm footprint on lockable wheels passes through standard doors. Standard 1", QF, CF, and ISO feedthrough ports and a front viewing window with rotatable shutter support flexible chamber integration.

APPLICATIONS

Thermal Evaporation System - ToronTES™ 1000 Applications

The ToronTES™ 1000 serves research and production thin film laboratories requiring multi-layer and co-evaporated metallic and inorganic film deposition with automated control and consistent deposition rates. Its 2×2 co-evaporation configuration

and QCM-based thickness control make it suited to research programs involving heterogeneous multilayer stacks, alloy films, and compositionally graded layers.

- **Metal Thin Film and Contact Deposition**: thermal evaporation of Au, Al, Cr, Ag, and other metallic films for semiconductor contacts, interconnects, and electrode metallization in device research programs
- **Multilayer Thin Film Deposition**: sequential evaporation of different material layers in a single pump-down cycle for optical coatings, magnetic multilayers, and functional device stacks
- **Co-Evaporation Alloy Film Research**: simultaneous dual-source co-evaporation for alloy and compound films with composition controlled by the relative power settings of each source channel
- **OLED and Organic Device Research**: thermal evaporation of metallic contact and charge-transport layers on organic device structures requiring clean high-vacuum metallic film deposition
- **Optical Mirror and Reflective Coating Deposition**: high-rate evaporation of metallic reflectors for optical component, photonic device, and telescope mirror fabrication
- **Solar Cell and Energy Device Research**: thermal evaporation of metallic back contacts, absorber layers, and thin-film device stack components for photovoltaic and energy device research programs
- **Academic and University Thin Film Research**: automated multi-layer deposition platform for teaching and materials research across metallic and inorganic thin film systems

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ToronTES™ 1000
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FEATURES

Thermal Evaporation System - ToronTES™ 1000 Key Features

The ToronTES™ 1000 integrates a 2×2 co-evaporation thermal source configuration, dual-channel QCM thickness monitoring, MFM gas control, and full LabVIEW-compatible automation in a compact, high-vacuum thin film deposition platform.

- **2×2 Channel, 12V to 200A Co-Evaporation Thermal Sources with Power Display**: four-source co-evaporation configuration with voltage-current power display for controlled sequential and simultaneous two-material deposition in a single pump-down cycle
- **0.1 Å/s Dual-Channel Thickness Monitoring with 1 to 4 QCMs**: multi-sensor thickness and rate monitoring with averaged-value output for improved measurement accuracy across co-deposition source channels
- **Fully Automated Layer-by-Layer Deposition**: automated control of each coating layer without operator intervention between deposition steps
- **Touch Screen and LCD Panel Control**: all system operations managed automatically through a touch screen interface with real-time LCD status displays
- **10^{-7} Torr Base Pressure, 10^{-6} Torr in 30 Minutes**: turbomolecular and mechanical pump stack with cryo and dry pump options; fast pump-down supports the 1.5-hour experiment cycle
- **Wide-Range Vacuum Control (1000 to 10^{-9} Torr)**: integrated vacuum measurement and control across the full range from atmospheric to deep vacuum
- **SS304 Chamber (30 to 60 cm, Prismatic or Cylindrical)**: clean, electro-polished surfaces in multiple box size options for different substrate and source configurations
- **Standard 1-inch, QF, CF, and ISO Feedthrough Ports**: configurable feedthrough selection for flexible gauge, source, and process gas integration
- **MFM Controlled Gas Inputs with Ar or N_2 Chamber Backfill**: mass flow meter controlled gas delivery with isolation valves for selective chamber atmosphere management and post-deposition backfill

- **Vacuum Hold with Isolation Valve**: the chamber remains under vacuum between experiments, reducing pump-down time and protecting film surfaces from atmospheric exposure
- **Optional 50 to 600 °C PID Sample Heating**: substrate temperature management for film crystallinity and deposition onto heated substrates
- **2 to 30 rpm Adjustable Sample Rotation**: continuous speed adjustment for uniform film thickness distribution across the substrate surface
- **Optional Sample Surface Cleaning by RF Plasma**: in-situ RF plasma cleaning of substrate surfaces before deposition without breaking vacuum
- **Automatic Closed-Loop Water Cooling**: thermal management of evaporation sources and chamber components during high-power co-evaporation runs
- **Internal Lighting and 120 °C Baking Capability**: chamber inspection lighting and baking for conditioning and residual moisture removal between runs
- **Front Viewing Window with Rotatable Shutter**: direct visual access for process monitoring with a rotatable shutter for precise deposition timing and chamber protection
- **1.5-Hour Experiment Cycle Time**: rapid pump-down and process execution supports multiple deposition runs per day
- **75×120 cm Mobile Platform on Lockable Wheels**: compact footprint passes through standard doors and allows flexible laboratory placement
- **One-Year Warranty for Design, Materials, and Workmanship**: annual coverage for system components and manufacturing quality

THEORY & METHOD

Theory and Method

Thermal evaporation deposits thin films by resistively heating a source material in high vacuum until it vaporizes, releasing atoms that condense on substrates above. A high-current supply drives current through a resistive boat, coil, or basket,

rapidly heating the source to its vapor pressure threshold. At pressures below 10^{-5} Torr, atoms travel without scattering and condense uniformly as a thin film. The 12V to 200A power supply with voltage-current display gives the operator direct control over the evaporation rate throughout the deposition.

The 2×2 co-evaporation configuration powers two channels simultaneously, each serving two sources, for deposition of two materials in a single pump-down cycle. Co-evaporation produces alloy and compound films whose composition is set by the relative evaporation rates of each channel. A dual-channel QCM controller with 1 to 4 sensors and averaged-value output monitors each material's rate in real time. Sequential operation of separate channels deposits distinct material layers without changing the substrate position or venting the chamber.

The turbomolecular and mechanical pump combination reaches 10^{-7} Torr base pressure across a wide-range 1000 to 10^{-9} Torr measurement system, supporting both metallic evaporation and multi-layer deposition. MFM-controlled Ar or N_2 gas inputs enable selective chamber backfill and controlled atmosphere conditions. An optional 50 to 600 °C PID substrate heater with 2 to 30 rpm rotation and optional RF plasma cleaning extends the process preparation range. Automatic closed-loop water cooling and 120 °C internal baking maintain system condition between depositions.

TECHNICAL SPECIFICATIONS

Thermal Evaporation System - ToronTES™ 1000 Technical Specifications

Parameter	Specification
Thermal Sources	2×2 channel co-evaporation configuration (4 sources)
Source Power Supply	12V to 200A per channel; voltage-current power display
Base Pressure	10^{-7} Torr
Working Vacuum (Pump-Down Time)	10^{-6} Torr in 30 minutes
Vacuum Control Range	1000 to 10^{-9} Torr

Parameter	Specification
Pump Configuration	Turbomolecular + Mechanical (cryo and dry pump as options)
Chamber Material	SS304 (prismatic or cylindrical); electro-polished
Chamber Sizes	30/40/50/60 cm box size
Feedthrough Ports	Standard 1-inch, QF, CF, ISO
Substrate Heating (Optional)	50 to 600 °C (PID controlled)
Sample Rotation Speed	2 to 30 rpm (adjustable)
Plasma Cleaning (Optional)	RF plasma (substrate surface)
Thickness Monitoring	Dual-channel; 0.1 Å/s; 1 to 4 QCMs; averaged value
Gas Inputs	MFM controlled; Ar or N_2 backfill; isolation valves
Cooling System	Automatic closed-loop water cooling
Internal Baking	Up to 120 °C
Observation Window	Front viewing window; rotatable shutter
Control System	Fully automatic computer control; touch screen; real-time LCD
Experiment Cycle Time	1.5 hours
Footprint	75 × 120 cm
Door Clearance	Passes through standard doors
Mobility	Lockable wheels
Warranty	1 year (design, materials, and workmanship)

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