

# MIRAD

## Infrared irradiator



Fig. 1. Photo of Mirad irradiator

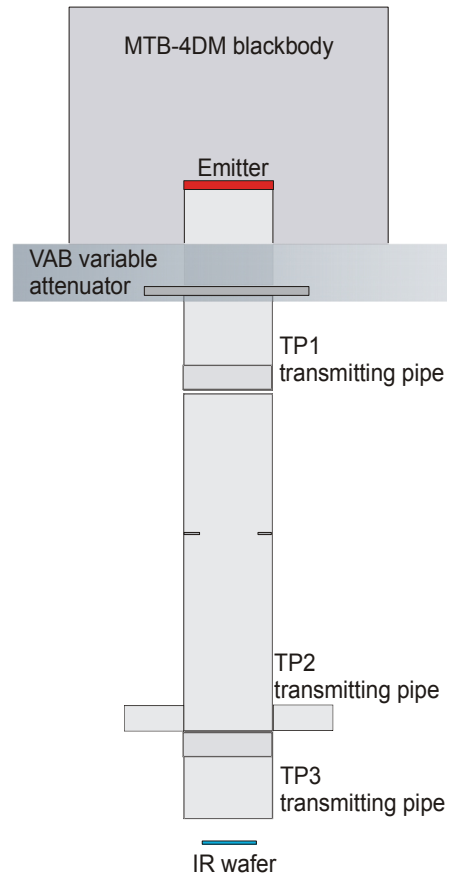


Fig. 2. Block diagram of Mirad irradiator

### 1. BASIC INFORMATION:

Mirad is a infrared irradiator optimized to work as a block of machines that test semiconductor wafers used to manufacture LWIR/MWIR FPA imaging sensors. In detail, Mirad has been designed to replace IA-OPT385WL illuminator (emitting light in VIS-SWIR band) in IP750 Image Testing machine from Tera-dyne Inc. In other words, Mirad is a middle/far infrared radiation source that can irradiate tested wafer with regulated intensity and high uniformity. MIRAD can be also optimized to work as irradiator in other semiconductor wafers test machines offered on international market.

Design of MIRAD irradiator is based on a concept to integrate three blocks (MTB medium temperature area blackbody, VAB opto- mechanical radiation attenuator, and three part TP transmitting pipe to create a radiation source capable to generate uniform and variable intensity MWIR/LWIR irradiation at wafer plane located several dozen of millimeters from the pipe output.

In detail, MTB works as a high intensity area radiation source of maximal temperature as high as 550°C that emits its radiation into direction of TP transmitting pipe. The amount of radiation that enters the TP pipe is regulated using VAB attenuator that mechanically regulates active area of input aperture of TP pipe. The TP transmitting pipe built from three blocks works at the same time as a highly efficient transmitting pipe and as an efficient optical integrator and beam shaper. The first function is needed to achieve high maximal irradiation level at the wafer plane. The second function is needed to achieve high irradiation uniformity at the wafer plane.

Regulation of irradiation can be done by regulation of temperature of MTB blackbody (slow method) or using VAB attenuator (fast method). The latter method enables changing irradiation from zero to maximal level in time of about dozen seconds.

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### 1. FEATURES

- Design of Mirad is optimized for use in semiconductor industry. Heat emission of MTB blackbody has been significantly reduced comparing to typical blackbodies. Air passing through VAB attenuator is filtered. Optical elements inside the transmitting pipes protect the semiconductor wafer against particles that can drop from coating of high temperature emitter of MTB blackbody.
- Mirad irradiator is fully computerized. Mirad Control program enables remote control of both temperature of MTB blackbody and attenuation of VAB variable attenuator. User can set single value required temperature and attenuation or can set complex temporal profile when software automatically changes irradiation from one level to another after specified time interval. Software can also calculate irradiance at wafer plane at desired spectral band.

### 2. TECHNICAL SPECIFICATIONS

Parameter	Value
<i>General parameters</i>	
Distance end of TP3 pipe to the sensor plane	required distance → 28 mm (irradiation at other distances can be different)
Maximal broadband irradiance at wafer plane	at least 8 mW/cm <sup>2</sup> (check test report for details)
Maximal area for tested sensor	circle of 60mm diameter
Recommended area for tested sensor	Not bigger than circle of 40mm diameter
Irradiation non uniformity	< ±2% at circle 30 mm < ±3% at circle 50 mm < ±5% at circle 60 mm
Spectral band of emitted radiation	From 0.7µm to 30 µm
Spectrum of emitted radiation	resemble Planck spectrum for set blackbody temperature
<i>Blackbody parameters</i>	
Temperature range of the blackbody	50°C to 550°C but recommended ≤ 500°C
Blackbody area	Circle 120 mm
Blackbody effective area	Circle 90 mm
Regulation resolution	10mK
Temporal stability	Not worse than 50 mK
Control	From PC via USB
<i>VAB attenuator</i>	
Transmittance range	From 0% to 100%
Resolution of regulation of transmission	Not worse than 0.1%
Clean air filters	Yes
Control	From PC via USB
<i>TP1/TP2/TP3 pipes</i>	
Dimensions	Optimized for IP750 image testing machine
Design	Barrel with internal baffles, integrating optics and beam shaper
Transmittance	Uniform in range from 1 µm to over 30 µm
<i>Other parameters</i>	
Working temperature	+5°C to 35°C
Storage temperature	-5°C to 55°C
Working humidity	Up to 75%
Storage humidity	Up to 50%

\*specifications are subject to change without prior notice

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