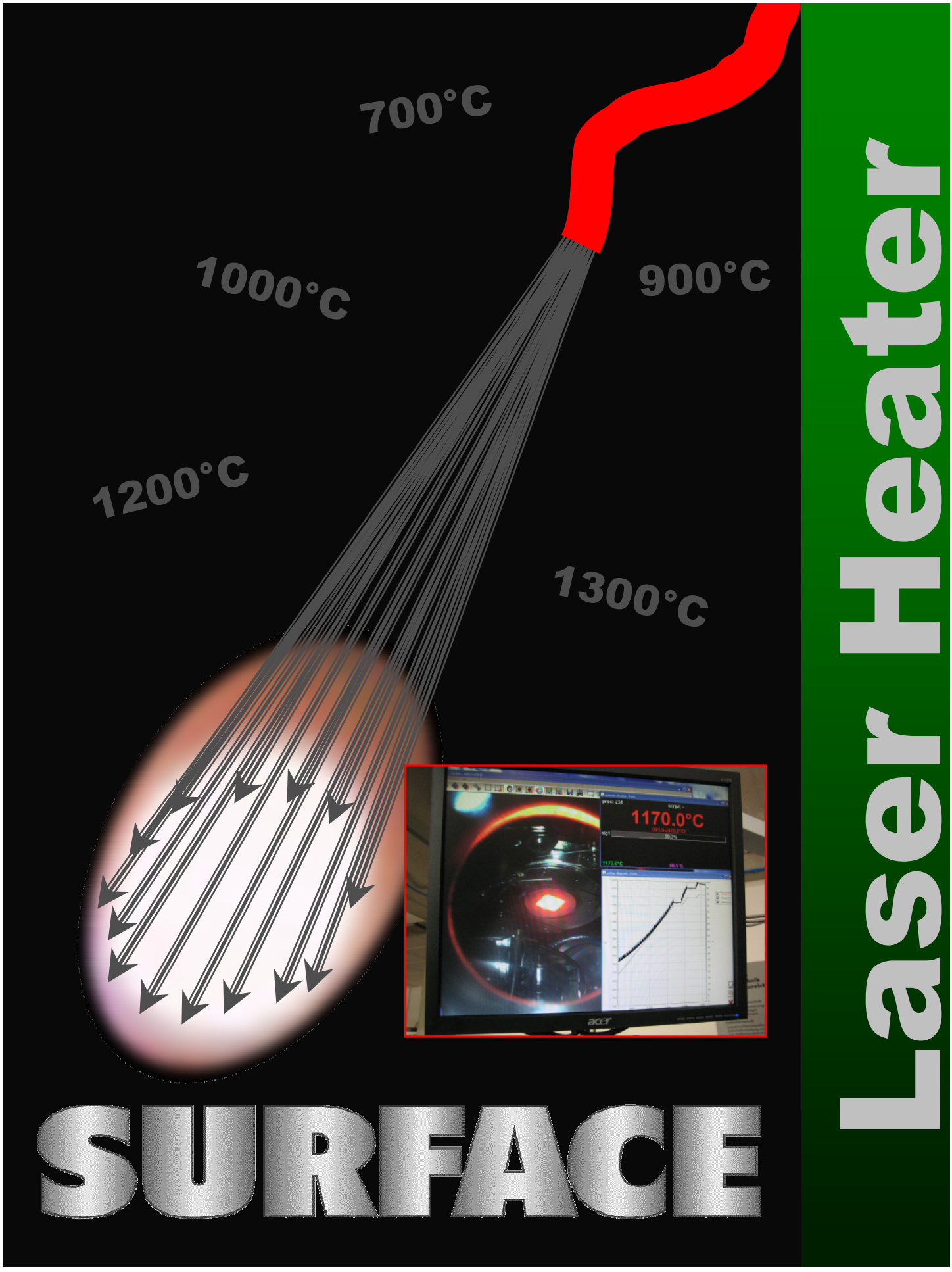
Laser Heater



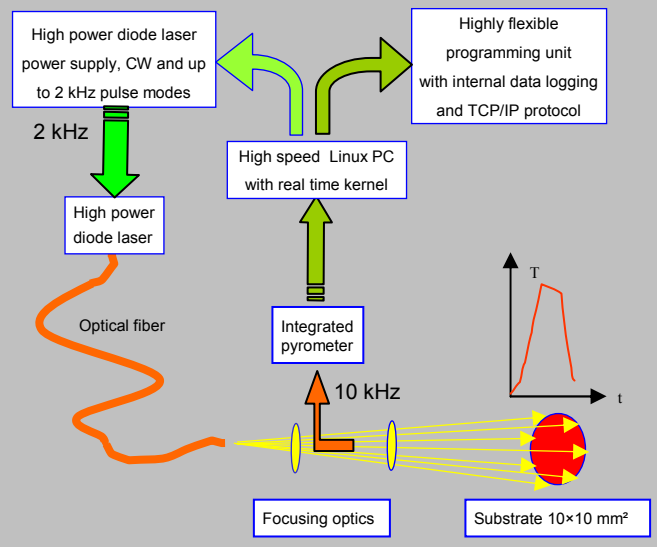
High Power Diode Laser - the Ideal UHV Heater

Temperature is one of the most important physical parameters for the epitaxial growth of thin films. Generating high temperatures in UHV applications is always a compromise between the requirements of the process and the available heat sources suitable for these temperature and process conditions. For conventional heaters, the individual vapor pressures of the component materials of the heater add up and generate a partial pressure that could limit the achievable UHV conditions and deteriorate process quality. This problem even increases with temperature and with the demand for oxidation resistance of the heater material. In addition, the heat capacity of the heater assembly limits the heating/cooling rates.

Conventional radiation heaters from SURFACE are built in different sizes – for substrates from 5×5 mm² to 150×150 mm² – and are suitable for up to 1000 °C.

SURFACE has developed a ***laser heating system*** for substrate sizes of up to 15×15 mm², using the latest available diode laser technology with powers from 100 to 350 W, which avoids the problems of conventional heaters mentioned above. The ***laser heater*** modules offered by SURFACE are compact, highly flexible, and ready to use, shipped with all necessary components:

- laser module with power supply and cooling
- optical fiber and focusing optics
- control unit for advanced laser processing



Block diagram of the advanced SURFACE laser heater system

The Main Features of Laser Heating

+ better vacuum at high substrate temperatures: 1200°C at 10^{-8} mbar
+ higher temperatures – regardless of the process pressure: 1300°C, 1400°C...
+ virtually any temperature ramp possible – only limited by substrate and film material properties
+ flash heating of thin films
+ flash crystallization of amorphous thin films

– only suitable for small substrate sizes if high temperatures are needed
– higher cost compared to conventional heater technology (expensive diodes and advanced cooling required)

Advanced Processing: *Cleaning, Heating, Annealing…*

CW mode

- standard laser heating of small substrates in UHV applications – especially Laser MBE
- post process tempering at any oxygen pressure
- for in-situ cleaning of Si substrates to remove the native oxide layer

Pulsed mode

- flash annealing of thin films, to recrystallize a film or to modify the grain size of such a film
- annealing of small nano-/micro-structures without heating the underlying substrate

Laser/pyrometer head integrated in the substrate manipulator flange

Laser with power supply in its control box close to the vacuum chamber

Specifications:

Laser:	CW and PM up to 2 kHz
Wave length:	940 nm
Output power:	100, 140, 350 W
Optical fiber:	600 µm ø, 5 m long
Pyrometer:	single or dual wavelength, range 1.2...1.8 µm up to 10 kHz sample rate
Controller:	real time OS system, TCP/IP interface, data logging

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