

Technical note on power pulse mode in Annealsys RTP machines.

1. ANNEALING IN PULSE MODE

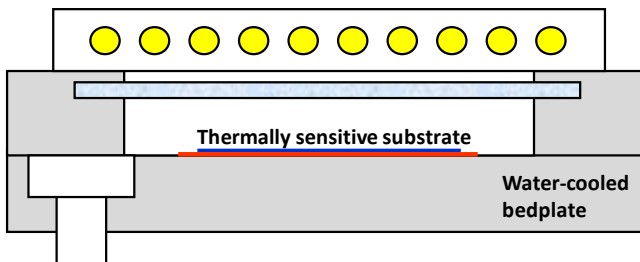
Annealsys expands the capabilities of its fast annealing furnaces with the ability to work under vacuum, reduced pressure or secondary vacuum and in a wide temperature range.

At the request of its customers Annealsys has developed a pulsed annealing mode in order to anneal layers that are deposited on thermally sensitive substrates.

Thanks to Annealsys cold wall furnace technology, the substrate can be cooled by the back side while heating the upper surface with a gradient of several hundred degrees between the two faces of the substrate.

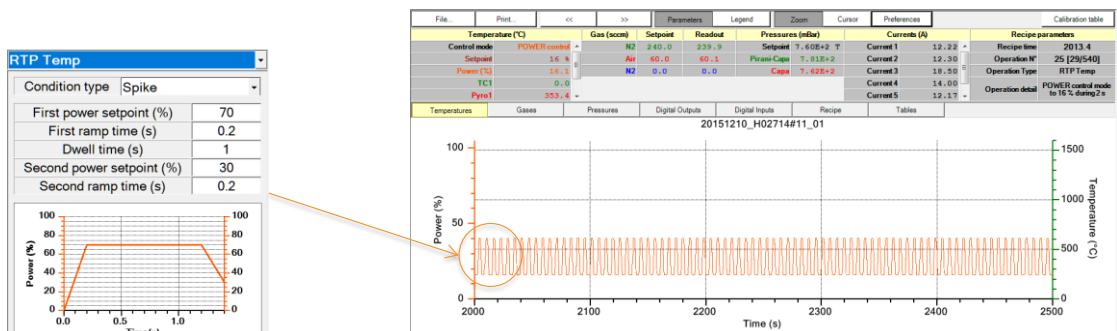
The temperature controller developed by Annealsys allows defining a peak power profile with a temporal resolution of 10 ms. Although the process is carried out in an open loop, the power converters specially developed to power the lamps provide excellent reproducibility.

This allows the use of this annealing mode in production for several years.



Capability to anneal layers on top of thermally sensitive substrate installing the substrate on the water cooled bedplate and using the power pulse annealing

The pulse mode and loop function of the software allows easy programming of power pulses.



This solution makes it possible to envisage the development of new methods of fast annealing.

2. TECHNICAL NOTE

2.1 Pulse annealing mode

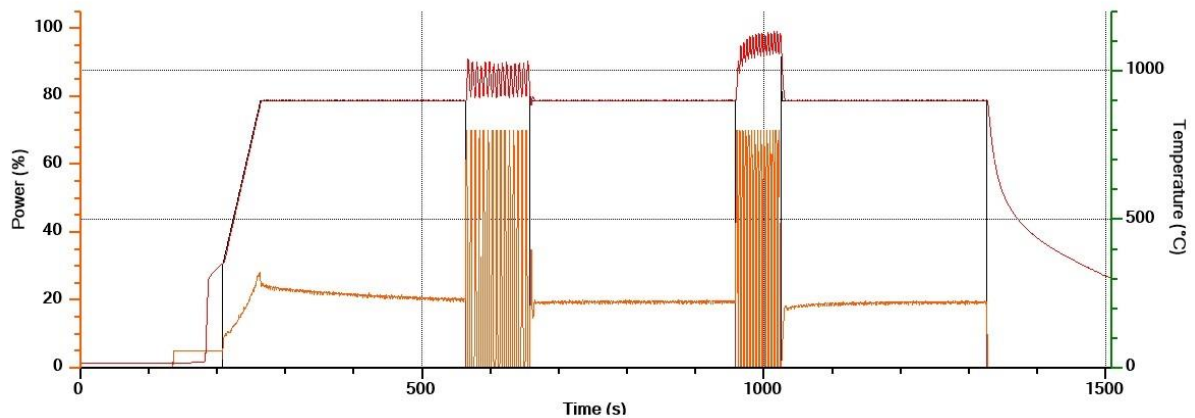
The pulse mode of the Annealsys RTP system allows generating power pulses with an accuracy of 10 ms. The power pulses are typically in the range of 1 second due to the response time of the halogen lamps.

It is possible to set the following parameters of the power pulses:

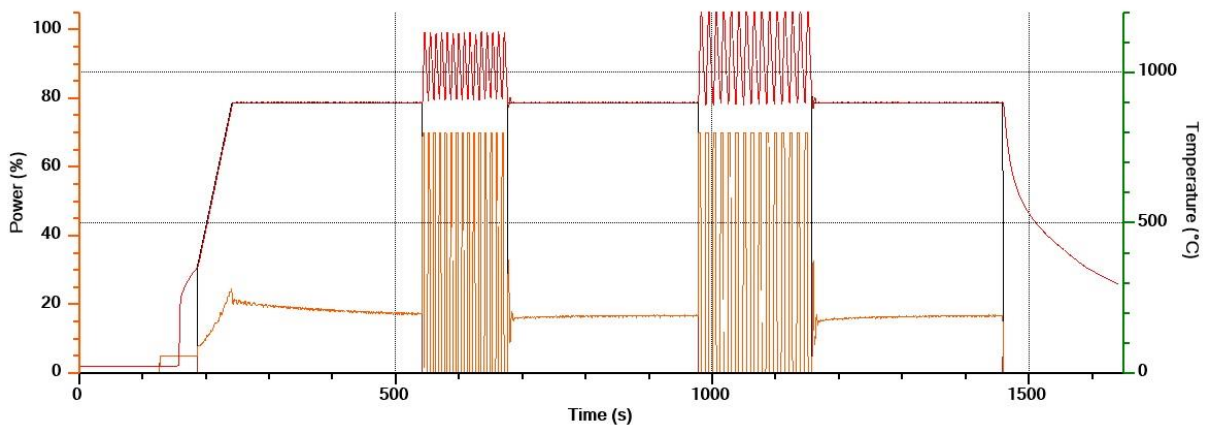
- Starting power level
- Ramping time
- High power of the pulse at the end of the ramp
- Ramp down of the pulse

This makes possible to have a background temperature (400°C for example) and to generate power pulse starting from this temperature. The pulses can eventually be controlled by the pyrometer.

Example of power pulse with duration control and temperature background of 900°C:



Example of power pulse with temperature control and temperature background of 900°C:

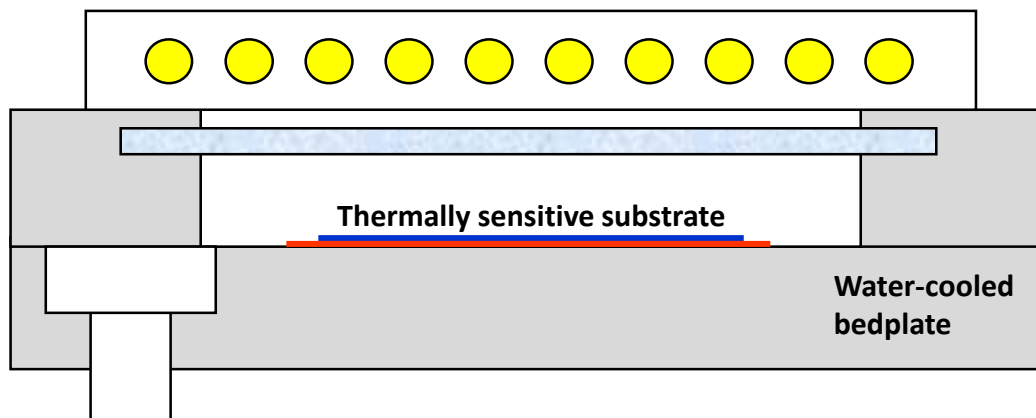


The control of the power and duration of the pulses allows controlling the pulse energy from 5 to 100 Joules per pulse. The system allows a very fine tuning of the power and energy of the pulses.

This tuning of the power pulse energy is in the same level as a fast annealing system using flash lamps.

The preheating temperature can be controlled in the temperature range of the machine with an accuracy of $\pm 1^\circ\text{C}$.

The machine also offers the capability of backside cooling of the substrate in order to increase the temperature gradient between the top side and the backside of the sample as shown on the following picture.



Capability to anneal layers on top of thermally sensitive substrate installing the substrate on the water cooled bedplate and using the power pulse annealing

It is possible to generate pulses with duty cycle in the range of 1 to 2 seconds.

Wavelength: from visible up to 4 μm

Uniform exposure uniformity with high repeatability thanks to the power control of the lamps using special power converters.

The Annealsys RTP system can anneal wafers installed on the standard quartz pins or smaller pieces installed on a susceptor.

Annealsys can propose to run demo samples in its laboratory.

About Annealsys:

Founded in 2004, Annealsys with more than 300 machines installed in 45 countries, is a leading manufacturer of Rapid Thermal Processing (RTP) and Direct Liquid Injection Deposition systems. We are supplying number of companies with production tools for the manufacturing of MEMS, sensors, optoelectronics, telecommunication, power and discrete devices.

Our philosophy involves building up a long-term relationship with our customers, providing high reliability and high quality tools, insuring low cost of ownership and offering outstanding customer support and service. To achieve this, we have created a worldwide network with trained engineers for sales and service.

For more information contact Annealsys at sales@annealsys.com