Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:M22-302L^
Published: 4/5/2023

Inventors

Shaopeng Wang

Rui Wang

Pengfei Zhang

Contact

Jovan Heusser
jovan.heusser@skysonginnovations.com

Rapid Regulation of Local Temperature with Wide-Field Plasmonic Thermal Microscopy

Temperature is a critical parameter for cellular activity regulations. Common temperature control techniques for cellular analyses utilize heating sources, which are often nonuniform over the target surface and time consuming. Plasmonic absorption of light, has been shown to be efficient in regulating localized heat rapidly and feasibly. It can be used to facilitate many practical applications such as photothermal therapy, neuron activation, phase separation, gas sensing and heterogeneous catalysis. However, plasmonic heating doesn't provide uniform temperature regulation in a wide field.

Researchers at the Biodesign Center of Arizona State University have developed a novel system, using wide-field plasmonic thermal microscopy (W-PTM), to provide rapid temperature regulation. This system provides a temperature regulation range of 33-80 °C, with no overheating effects, and has imaging capability as well. Compared to traditional microheating methods, W-PTM is more precise and enables more controlled microregion heating. This system can also analyze thermal transition kinetic processes at the single-molecule or single-particle scale.

This W-PTM system can be used for noninvasive and local regulation of temperature combined with imaging to provide a powerful tool to study cellular activities.

Potential Applications

- Local temperature regulation
  - Studying the temperature responsiveness of living cells and cellular processes

Benefits and Advantages

- Based on plasmonic scattering microscopy
  - Shares the same advantages of PSM over traditional SPR systems
- Enables easy monitoring of thermal dynamics in the time domain
- Does not record a strong reflection
  - Allowing incident intensity up to 3kW/cm2 so that a die temperature regulation range can be achieved from room temperature to ~80°C
- Can integrate with fluorescence detection approaches, whose signals are massively dissipated through the gold surface in traditional SPR systems
- Provides 1ms temporal resolution for rapid, real-time counting of particles

For more information about this opportunity, please see

Wang et al - Anal Chem - 2022

For more information about the inventor(s) and their research, please see

Dr. Wang's departmental webpage

Dr. Wang’s laboratory webpage