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Inventors

Owen Hildreth

Galen Arnold

Aric Sanders

Contact

Shen Yan
shen.yan@skysonginnovations.
com

Non-Contact Methods to Locate Sharp Tips

As 3D printing has become increasingly popular in recent years, 3D printing at the micro-scale has also emerged with many medical and industrial applications. These 3D micro-printers use sharp ($\sim 1 \mu\text{m}$) pipettes to print features on the scale of 100 nanometers. To do this, the pipette tip must be precisely located in space so that it can be kept a few micrometers above a substrate. The current process for locating the tip involves monitoring the contact resistance between the substrate and the tip. Unfortunately, this process is slow, damages the tip, and does not work for non-conducting tips. Therefore, there is a need for a non-contact method for locating the pipette tip during micro-scale 3D printing.

Researchers at Arizona State University have invented a process to locate ultra-small objects or tips using focused light. The light scatters from the pipette tip whenever the tip passes through the focused beam. A camera monitors the scattering and maps out the precise position of the tip relative to the focused beam and the substrate. This invention radically simplifies the process by accurately and precisely locating the tip in a manner that is faster, easier, and significantly cheaper than current methods. Additionally, this process broadens the types of materials that can be used for tips and substrates by eliminating the need to monitor electrical resistance.

Potential Applications

- 3D printing
- 3D micro-printing
- Additive manufacturing
- Rapid prototyping

Benefits and Advantages

- Faster – Dramatically reduces the time needed to locate the tip.
- Increased Range of Application - Broadens the types of materials that can be used for tips and substrates by eliminating the need to monitor electrical resistance. Works with nonconductive SiO₂ tips.
- Increased Accuracy and Precision – Exact position of the tip determined through the use of lasers and camera monitors.
- Less Expensive – Cheaper than current methods and inexpensive to implement.

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

[Dr. Owen Hildreth's directory webpage](#)

