Photothermal heating in metal-embedded microtools for material transport.

Material transport is an important mechanism in microfluidics and drug delivery. The methods and solutions found in literature involve passively diffusing structures, microneedles and chemically fueled structures. In this work, we make use of optically actuated microtools with embedded metal layer as heating element for controlled loading and release. The new microtools take advantage of the photothermal-induced convection current to load and unload cargo. We also discuss some challenges encountered in realizing a self-contained polymerized microtool. Microfluidic mixing, fluid flow control and convection currents have been demonstrated both experimentally and numerically for static metal thin films or passively floating nanoparticles. Here we show an integration of aforementioned functionalities in an opticallyfabricated and actuated microtool. As proof of concept, we demonstrate loading and unloading of beads. This can be extended to controlled transport and release of genetic material, bio-molecules, fluorescent dyes. We envisioned these microtools to be an important addition to the portfolio of structure-mediated contemporary biophotonics.

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