Laser-direct-write creation of 3-dimensional micro-cages for contact-free handling of neutral species in solution

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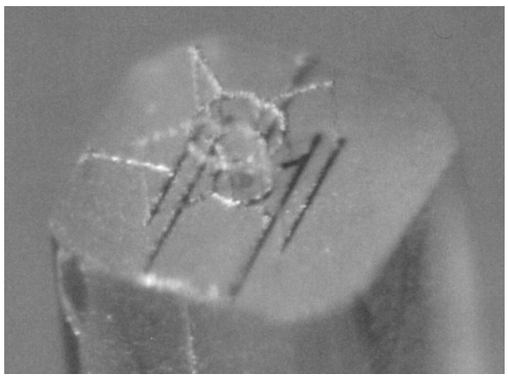
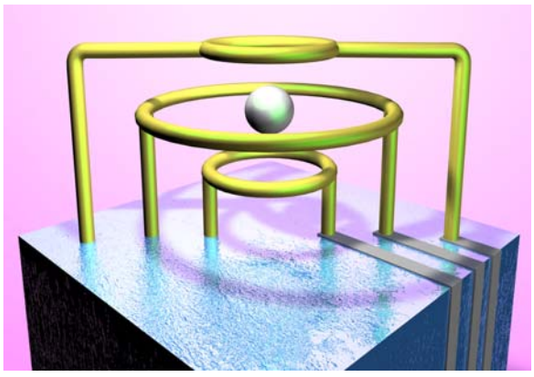
In this work the creation of a 3-dimensional microelectrode trap is described and used for contact-free trapping, handling and transfer of small neutral objects in aqueous solution. A green laser beam is focussed through a microscope objective and a 3 mm window onto a suitable substrate in contact to a gas phase mixture of an aluminum precursor, oxygen and a buffer gas. The laser beam induces spatially selective decomposition of dimethylethylaminealane (CH3)2C2H5N.AlH3 forming aluminum Al or aluminum-oxide, the latter if oxygen is present as well. In this way, a stable insulating ceramic structure or a conducting metal can be created. The controlled 3D growth is achieved by suitably moving the laser beam focus away from the surface with the speed of growth (50 µm/s) of the material deposited.

.In this way, structures with special mechanical , such as a micromotor, optical , such as a photonic bandgap material, or complex morphologies can be achieved.





The following examples will be presented in the talk:

- trap object into cage
- move cage inside solution keeping trapped species in stable position
- position for free access from all directions
- bring object, force into trap
- form pair, pick up against gravity
- separate pair
- pick up aggregate