# Catalytic Micro-Nanotube Engines

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**Abstract**

We present a new strategy to create efficient catalytic micro- /nano-engines based on rolled-up micro-/nanotubes [1,2]. For this purpose we deposit and roll up a metal layer stack on a substrate, so that the inner surface of the tube consists of a catalytically active metal (e.g. silver, platinum). Once the rolled-up tubes are released in a diluted H2O2 solution, a catalytic reaction inside the tube body causes the formation of oxygen bubbles, which are thrusted out at one side of the tube. In this way the tube (or jet engine) can self-propel by the repulsion principle. The speed of the engines can reach more the 50 tube lengths per second. We can control the direction of movement by external magnetic fields and large cargo can be tranported and released in a deterministic fashion. The size and symmetry of the engines can be readily designed by material selection and on-chip lithographic procedures. Our approach allows for a versatile design of multifunctional and size scalable micro-/nanorobots in fluids. We expect that functionalisation of the inner tube walls with biocatalytic molecules will enable operation of the engines in non-toxic environments.

[1] Y.F. Mei et al., Advanced Materials 20, 4085 (2008)
[2] A.A. Solovev et al., Small 5, 1688 (2009)