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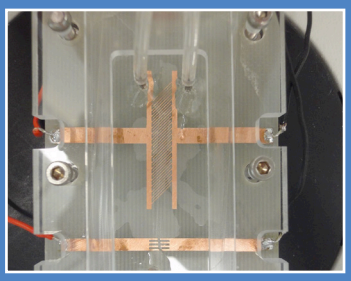
SelfSys

FLUIDIC-MEDIATED SELF-ASSEMBLY FOR HYBRID FUNCTIONAL MICRO/NANOSYSTEMS



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What it's about…

Developing a completely new manufacturing method based on liquid-mediated self-assembly of smart MEMS parts that are liquid filled and that can release this liquid upon a trigger signal in a self-powered fashion.

Context and project goals

The goal of the project is to develop a novel manufacturing method capable of assembling a large number of pre-fabricated smart MEMS devices into more complex systems by using liquid media. An additional goal is to trap liquid inside the assembled MEMS that can be released upon an external trigger signal. These devices may find applications in environmental engineering, drug release, miniaturized chemical systems, etc.

How the project differentiates from similar competition in the field

The consortium has not seen any other work published that aims for the self-organized assembly of smart MEMS parts that are filled with liquid. Despite the fact that such devices may be fabricated by more conventional assembly techniques, defining a scenario applicable for a large number of very small parts, the use of natural self-assembly forces seems still the only viable solution at this point.

Quick summary of the project status and key results

The various project parts have been brought to a conclusion: a) MEMS processing using colored SU-8, b) surface functionalization, c) improved control of self-assembly achieved by surface functionalization (hydrophobic, hydrophilic contrast), d) the assembly chamber using piezo-actuators has been improved and modeled in detail allowing for switching between assembly and dis-assembly modes, e) High-speed real-time tracking and control of the MEMS motion has been demonstrated, f) assembly yield statistics established, g) colored ink has been trapped in MEMS and released upon chemical trigger.

Success stories

SelfSys results have attracted the interest of industry (Debiopharm) which led to a new project proposal (CAPSULE) for controlled drug release that has been retained by the SNSF evaluation for the next Nano-Tera.ch phase.

Main publications

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L. Jacot-Descombes, C. Martin-Olmes, M. R. Gullo, V. J. Cadarso, G. Mermoud, L. Guillermo, M. Mastrangeli, A. Martinoli and J. Brugger, Self-assembly of two-component liquid-filled MEMS based micro-capsules,, Soft Matter, 9 (41) 2013

Jonas Goldowsky, Helmut F. Knapp, Gas penetration through pneumatically driven PDMS micro valves, RSC Advances Issue 39, 2013