



Directed Self-Assembly, Reconfigurable Manufacturing for Microsystems

Technology No. z05009

IP Status: Issued US Patent; **Application #:** 11/375,701

Directed Self-Assembly Uses Geometric Shape Recognition to Improve Reconfigurable Manufacturing

Programmable Reconfigurable Fluid 3D Manufacturing enables the parallel fabrication of three dimensional multi-component microsystems. It can be used to assemble multi-chip modules, hybrid systems, and micro-opto-electro-mechanical systems that consist of non-identical components. Such systems cannot be assembled using conventional self-assembly because the components are only micrometers in size and too small for standard robotics to handle. The programmability and the ability to recognize different objects are important advantages this process has over other techniques. The manufacturing process is based on a new form of directed self-assembly that uses geometric shape recognition to identify different components. Programmable solder based receptors and metallic binding sites are used to form mechanical and electrical interconnects.

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Self-Assembly is Faster than Robotic Manufacturing

Programmable reconfigurable manufacturing overcomes many shortfalls of existing technologies. This manufacturing process works for two dimensional and three dimensional components, is highly parallel, and is much faster than robotic manufacturing. Programmable reconfigurable manufacturing can manufacture 10,000 microsystems in the same amount of time it takes to manufacture one hybrid system. The directed self-assembly method is programmable and enables batch integration of different devices. This is not possible with existing fluidic self-assembly technologies because of their insufficient ability to recognize different components. The programmable manufacturing method utilizes hybrid integration of functional components on planar and curved surfaces. Microsystems are self-assembled by sequentially adding parts to the assembly solution. Metal contacts bind to liquid-solder-based-receptors to assemble and electronically connect devices.

FEATURES OF PROGRAMMABLE RECONFIGURABLE FLUID MANUFACTURING:

- Highly parallel--fabrication of multi-component microsystems in three dimensions.
- Fast--self-assembly method makes manufacturing more efficient.
- Programmability--enables batch integration of different devices, this is not possible with existing fluidic self-assembly methods
- Reconfigurable--receptors can be reprogrammed to direct a new assembly process
- Geometric Shape Recognition--identifies different components to assemble microsystems that contain non-identical components.

Phase of Development Proof of concept complete. Two papers have been published and more work is underway to continue the technology development.

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