



PULSAMED

A MINIATURIZED SINGLE-USE GEAR PUMP FOR DRUG INFUSION

Project Summary

This purpose of this project is the development of a micropump for drug infusion. The design of the pump is essentially composed of two parts:

- The single use "wet" pump cell comprising the sealed pumping mechanism based on a miniaturized gear pump principle.
- The reusable command, including user interface and electronics. This unit comprises the electromagnetic stator, responsible for the actuation of the rotating gear.

The principal challenge of the development is to ensure the actuation of the pump by electromagnetic coupling through the walls of the pump cell. The second challenge is the microfabrication of the pump cell including chamber and gear wheels, with sub-millimeter feature size and micron tolerances.

The electromagnetic structure has been simulated using Flux-3D finite elements software. The parts have been micromachined using two technology approach:

- Monocrystalline silicon Deep Reactive Ion Etching (DRIE): the Bosch process has been installed on the reactor and optimized for the required specification but turned to be insufficient in terms of wall verticality.
- Wire Electric Discharge Machining (EDM) has been employed to cut the parts from metal sheets. Proper tolerances have been obtained after a few iterations but the required level of miniaturization has not been reached.

Finally, a pump structure has been micromachined and assembled but with dimensions slightly larger than the original (simulated) design. As a result, the electromagnetic actuation is not sufficient to ensure proper rotation and liquid pumping.

The feasibility of the electromagnetically coupled gear pump is therefore only partially established but the design parameters are now properly understood and the perspective for a successful second design are good.

Valorisation

The project is envisioned for a continuation as a CTI project, provided that an industrial partner is willing to carry on with this development. In the medical field, numerous applications require electromagnetic coupling through a wall. A project for a medical pump for body fluid is currently in discussion.

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