

MEMS and Opportunities for University/Industry Technology Transfer

Nico. F. de Rooij, Professor, University of Neuchatel, Switzerland

The primary role of the university is the education that bringing up the students as scientists and researchers in future. However the university has been implementing a collaboration based on the contract with the company for their commercial products.

It is thought some type of contracts for the collaboration such as the company provides only fund to have developed a certain technology by the university or the researchers of a company join to the collaboration at laboratory in the university. In such cases, it is thought some difference in every country regarding the ownership of patents and intellectual properties of developed technology and commercialized products based on the collaboration. However the fruits of the collaboration have been realized as products in the market. Today I will talk about MEMS and opportunities for technology transfer from university to industry.

Consumer products

Swiss is not thought without watch and is famous for that industry.

Recently the watch is incorporated a pressure sensor that can be measured the depth in the water and height on the land, and a gyro that can be showed the direction of north on the earth is also incorporated in a certain watch. In addition to these sensors, mechanical gears that move the watch hands are now also produced by MEMS technologies developed in later half of 1980s.

Nowadays these technologies are applying globally as if shared ones.

By the way I would like to inform you that 30,000 people are working in the watch industries in Swiss and the industry earns 2500 million U.S. Dollars annually.

Microfluidic dispensing system

In the next speech, Professor Nico F. de Rooij introduced us a micro bioreactor that was developed for space application that consists of piezoelectric micro-pump, flow sensor, 3ml chamber, microfabricated PH sensor and electronics controller.

This miniature bioreactor has been developed for the cultivation of yeast cells aboard in a space laboratory (space lab) and was used in three Space Shuttle missions.

The first experiment was conducted in "Spacelab 2nd International Microgravity Laboratory on STS-65" in 1994, secondly in "Spacelab in the Shuttle to Mir Mission SMM03" in March 1996, and the third mission in "Columbia STS-107" in February 2003 that was totally lost due to the terrible accident.

However the first results suggest that biological effects are indeed occurring in microgravity.

Since the flow sensor allowed measuring from micro to nano little, it was applied to microfluidic dispensing systems for pharmaceutical company. The system have advantages that are able to control the liquid quantity at the dispensing site, to read directly real time measurement of the aspirated or dispensed volume and to indicate the status of diagnostic of the system functionality (clogging etc). Nowadays a dispensing system equipped with a nozzle arrays with sensor controlled liquid handling, 5000nl to 25nl has been commercialized for pharmaceutical company.

Optical MEMS, Lab-on-Chip, Tool for Nanoscience

In addition to above systems, Professor Nico. F. de Rooij introduced us following MEMS products, as optical MEMS product : amplifiers, switches for optical communication, optical cross connectors, variable optical attenuators, fourier transform spectrometers, as lab-on-chip product : gas sensors, PH sensors, glucose sensor and μ TAS (Micro Total Analysis System) that equipped small analyzing system and as nanotool : a cantilever which is required for study in the nanoscience and nanotechnology and using for the probe of Scanning Tunneling Microscope (STM) and Scanning Force Microscope (SFM). The cantilever is a probe of new type that fabricated by MEMS technology.

Conclusion

I have been talked about MEMS technologies that transferred to the companies and I would like to close this lecture after I introduce the name of the companies.

Swiss is a small country that has a population of only 7 million and not having big enterprises like Japan and U.S.A. Now I would like to introduce the companies that transferred MEMS technology from Neuchatel University.

Intersema is an existing company fabricating pressure sensor, and MicroFlow Engineering is also an existing company which is producing inhalers.

Regarding the recent start-up companies: Seyonic SA (founded in 1998) which is engineering and manufacturing microfluidic systems for life science and space research, Sercalo Microtechnology SA (1999) which is producing optical MEMS switches and attenuators, and NanoWorld SA (2000) which is fabricating nonotools for scanning probe microscopy.

