

UPDATE ON TWO RECENTLY COMPLETED PROJECTS: Development of Uncooled Infrared (IR) Detector with Optical Readout (sponsor ASELSAN)

Ulaş Adıyan

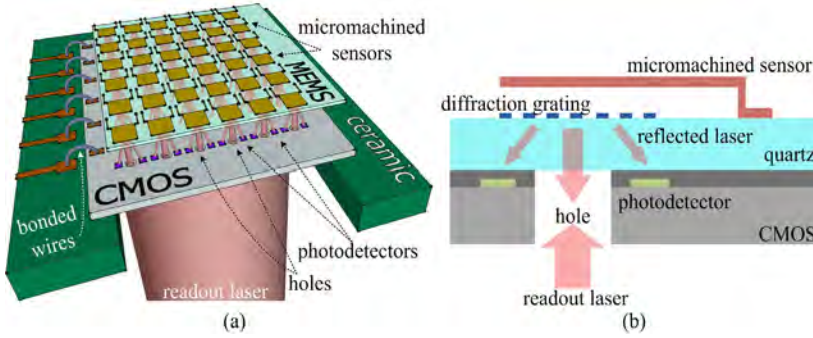


Figure 1: a) Integrated Sensor Array b) Side View of a Single Sensor

Thermal imaging has been a useful tool in many thermal mapping applications such as medical imaging, target detection, surveillance, monitoring circuits and rescue. In 2006, 1st Phase of the ASELSAN project, The Fabrication and Development Of MEMS Based Uncooled IR Detectors, was started in Koc University OML (Optical Microsystems Laboratory) and it was completed successfully in 2010. In the scope of 2nd Phase of the Aselsan project which was started in 2011, the design, fabrication and characterization of micro electro-mechanical system (MEMS) based uncooled thermo-mechanical infrared (IR) sensor arrays integrated with CMOS based optical readout are carried out. Pixelated sensor array operation is based on the conversion of incident IR radiation to

mechanical displacement. Sensor arrays are designed and microfabricated in 640x480, 320x240 and 64x64 pixel formats with 35 μm sensor pitch using standard MEMS processes with SixNy/Al and Parylene/Al material combinations. Optical readout IC is fabricated using standard 0.18 μm CMOS process. As a post-process, the CMOS chips are thinned and through wafer holes are etched, which allow the readout laser beam to pass through. After the CMOS post-process steps, MEMS and CMOS dies are aligned and integrated, which enabled a novel integrated optical readout. The tests of the MEMS sensors and the integrated sensor array were successfully performed. In May 2014, the final meeting of the project was held and the 2nd Phase of the project was completed.

Acknowledgement: This project was started in 2004 and included substantial contributions from OML team members Hamdi Torun, Onur Ferhanoğlu, Fatih Toy, Burak Erarslan, Selim Ölcer, Fehmi Çivitci, and Ulaş Adıyan; our collaborators at EPFL (Prof. Yusuf Leblebici's group) and METU-MEMS (Prof. Tayfun Akin's group); and many engineers from our sponsor Aselsan.

Functionalization of MEMS cantilever with nanostructures for bio-chemical sensor application (sponsor TUBITAK)

Necmettin Kılıç

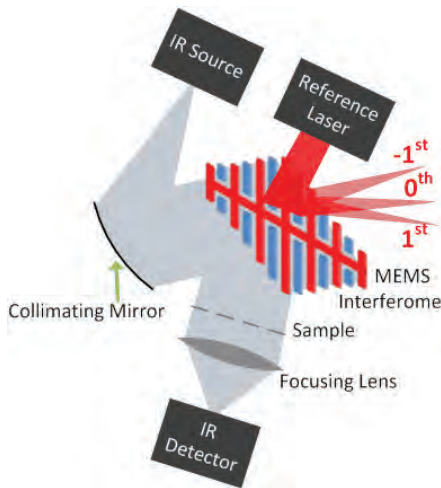
Collaboration between OML (Optical Microsystem Laboratory), Koç University and NNAG (Nanosensor and Nanodevice Research Group), Gebze Institute of Technology started with TUBITAK postdoctoral research fellowship project that is entitled "development of MEMS cantilever for precision measurements". In the scope of this project, cantilevers were fabricated by using different magnetic materials and gas sensor application of one-dimensional nano-metal oxide materials coated cantilevers was investigated. Gas sensors have been widely researched due to high application area such as industry (oil-chemical, mining, cosmetics-perfume, automotive, food, etc.), health, agriculture,

environment, defense and security. In general, the gas sensors consist of three main units that are analyte, sensitive materials and transducer.

OML and NNAG jointly proposed a two-year joint COST projects and it was accepted (2014-2016, project number: 113F403). The aim of this project is to produce one-dimensional metal oxide / polymer hybrid structures for gas sensor applications. In order to fabricate gas sensor devices, 1D metal oxide / polymer hybrid structures will be coated on different transducers such as interdigital transducer, cantilever and quartz crystal microbalance and then these sensors will be tested for volatile organic compound (VOC) gases.

For A Truly Portable FTIR Spectrometer with Sub-Second Measure Times

Sven Holmström



Overview of the core function of the LGI Spectrometer.



Mounted MEMS Interferometer.

MEMFIS was a successful 2.85 million Euro European Union FP7-program that lasted between 2008 and 2012, aiming to develop the world's smallest Fourier transform spectrometer. OML was the only university partner in the seven partner consortium. Fourier transform infrared (FTIR) spectroscopy has been the gold standard for IR spectroscopy for a variety of applications, such as chemical analysis of solids, fluids, gases, and process flows. Current FTIR spectrometers, however, are costly bench top laboratory instruments with measurement times of several seconds to minutes. The vision of MEMFIS was a truly portable FTIR spectrometer with sub-second measurement times. Such a device has the potential to open up new research directions and applications.

The approach of the project was to work simultaneously on two different solutions for the MEMS-based interferometer, which is at the core of the spectrometer. While Fraunhofer IPMS (Dresden, Germany) designed a miniature moving mirror for the traditional Michelson configuration, Koç headed the work on a solution using a lamellar grating interferometer (LGI). This work is based on a patent by Prof. Hakan Ürey and former PhD student Çağlar Ataman, granted in 2013. LGI is a dynamic diffraction grating operated at resonance that enables the FTIR spectrometer to be simpler, more robust, and to be operated at standard pressure.

The Second Koç University



On October 24, the “Project Brokerage Event” organized by the Research and Project Development Directorate and Technology Transfer Office (APGTTD) took place. OML participated to the event with its posters about Display Technologies and Non-invasive Milk Deterioration Detection Technique Based on Laser.

Koç University Summer



As part of Koç University Summer Research Program three high school students, Şule Kahraman from Robert College, Berk Toy and Onur Karaçoz from Kabataş Erkek Lisesi, participated in an OML research project. During the approximately five week long program, Şule Kahraman and Berk Toy produced a computer controlled microscope sample holder. To produce the sample holder they made use of old CD Room pieces and game console joysticks.

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ASELSAN
2015-2017



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Group Events of the OML



May 2014

Karting and Dinner in İstinye

On May 6 OML members organized another group activity in İstinye. After an exciting and amusing five round karting activity, the crew had a dinner at a Wrap House.

OML Bike Ride

On September 19, OML members organized a cycling tour from Koç University to Kilyos over Rumelifeneri. 15 members participated in the tour. When we arrived at Kilyos at noon, some went swimming. Afterwards the other OML members who did not participate to the tour joined the activity. After the lunch the group cycled to Koç University, this time over Zekeriyaköy. Total distance traveled was more than 50 km.



September 2014