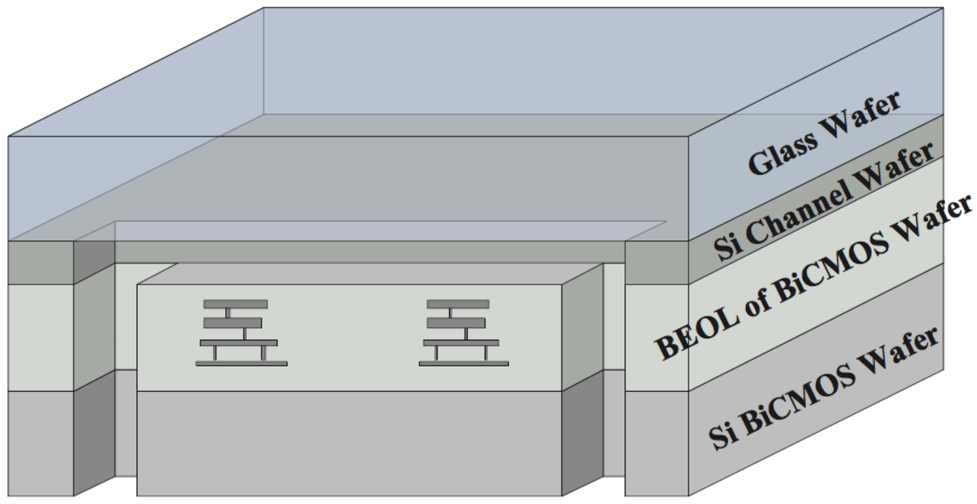
EW
ENGINEERING WALES
CONFERENCE

NRN162

BiCMOS/microfluidics lab-on-chip



INTRODUCTION

A BiCMOS-based microsystem integrating microfluidic channels, microwave signal generators and detectors has been developed basing on a novel wafer bonding technique. This lab-on-chip (LOC) platform affords high spatial resolution and sensitivity without the parasitics from connection to external modules and polymer packaging.

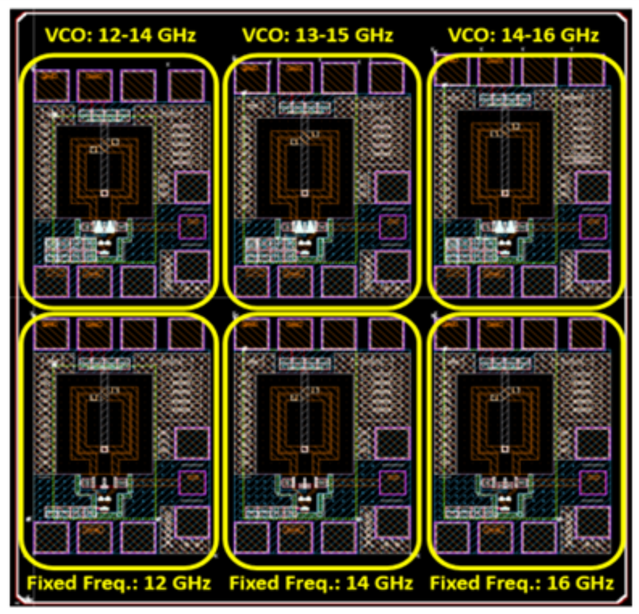
CONCLUSIONS

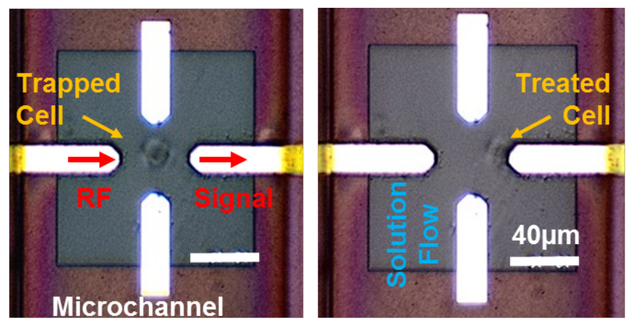
The developed wafer level integration technique combines a BiCMOS wafer, a silicon microfluidic channel wafer and a transparent glass sealing wafer to allow simultaneous optical and electrical measurements. The glass packaging approach and integrated power sources are key for accurate microwave energy delivery and detection. This is highly desirable for biomedical application such as discrimination, sorting and selective treatment of various types of cells.

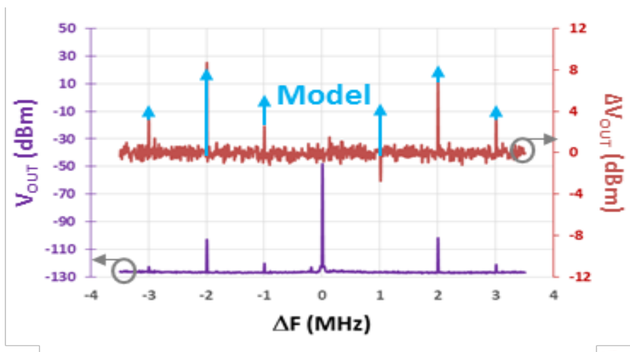
DEVELOPED LOC PLATFORM

Fusion bonding and adhesive bonding were used for a 3-wafer-stack integration of glass, silicon and BiCMOS wafers. The microfluidic inlet and outlet were positioned on the backside of the wafer stack to support both optical monitoring and electrical measurements on the front side. This wafer level integration technique supports high throughput detection, microfluidic control and stimulation of microscale samples through DC to mm-wave signals.

The new LOC platform has already demonstrated high sensitivity detection of cancer cell properties and viability along with monitoring and control of non-linear intracellular processes such as nano-electroporation.







REFERENCES:

[1] M. Inac et al. “BiCMOS integrated microfluidic packaging by wafer Bonding for Lab-on-Chip applications”, *Electronic Components and Technology Conf.*, DOI: 10.1109/ECTC.2017.153, June 2017.
[2] C. Palego et al., “BiCMOS microfluidic sensor for single cell label-free monitoring through microwave I ntermodulation”, *IEEE Intern. Microwave Symposium*, DOI: 10.1109/MWSYM.2016.7540266, June 2016.

Co-I: Chris Hancock
Creo Medical Ltd.
+44 1291 606005
Cris.Hancock@creomedical.com

Co-I: Adrian Porch
Cardiff University
+44 2920 875954
porcha@cardiff.ac.uk

Co-I: Mehmet Kaynak
IHP Microelectronics, Germany
+49 335 5625 707
kaynak@ihp-microelectronics .com

Additional Collaborator: Arnaud Pothier
XLIM/Université de Limoges, France
+33 555 457 263
arnaud.pothier@xlim.fr

ENGINEERING RESEARCH NETWORK WALES
RHWYDWAITH YMCHWIL PEIRIANNEG CYMRU

Noddir gan Lywodraeth Cymru
Sponsored by Welsh Government
Cyngor Cyllido Addysg Uwch Cymru
Higher Education Funding Council for Wales
hefcw

www.ernw.ac.uk

HORIZON 2020
Grant Agreement No: 737164

www.sumcastec.eu
Sumcastec

PI: Cristiano Palego | Senior Lecturer | Bangor University | c.palego@bangor.ac.uk | www.bangor.ac.uk

PRIFYSGOL BANGOR UNIVERSITY