Fully Integrated Magnetic Barcode Labeled Microfluidic System for Multiple BioAssays

Liquid Bearing Micromotor

Microfluidic Reactor for Continuous Process Nanoparticle Synthesis

Low Cost BioFluidic Amplification & Biomarker Reader
Micropower

MEMS Supercapacitor

BioMass Energy Harvester

Folded Cantilever Motional Energy Harvester

Microcolumnated Heat Pipe Loop For Cooling

Micro Energy Harvesting & Storage
Smart Grid & Demand Response
Current & Voltage Monitoring
Device Cooling
NanoPlasmonics; Microphotonics; Imaging

- Optical Interconnects
- Nanocavity LED
- Optical Nano Plasmonic Antenna
- OptoFluidics
- Light-Actuated Digital Microfluidics
- Single Cell Manipulation

Photodetection & Optomechanics
MicroLaser/Photonic Integration
Surface Enhanced Raman Spectroscopy
Molecular Imaging
NanoTechnology & NanoEngineering

Large Area Printed Nanoelectronics

Conformal Photovoltaics
Sensory Skin

Electrospun Active Fabrics
TiO2 Nanoswords for Clean Energy

Photovoltaics & Printed Electronics
Artificial Skin
Microreactors
Compound Semiconductor
Chemomechanical Signal Transduction
Physical Sensors & Devices

Ultrasonic Imaging & Ranging

Piezoelectric Ultrasound Transducer

Bioinspired Polymer IR Detector

Energy Industries

Geothermal

Oil & Gas Exploration

Industrial Gas Turbines

Automotive Engines

Aircraft Engines

Minimum Sensing Temperatures

374°C

275°C

600°C

300°C

Desired Sensing Measurands

Pressure Temperature

H₂S Strain

Pressure Temperature

Hydrocarbon Strain

Pressure Temperature

Flame Speed Acceleration

Pressure Temperature

Flame Speed Acceleration

Harsh Environment Wireless Sensors

Harsh Environment
Materials, Processes, Devices
Gyroscope, Magnetic, Inertial Sensing
Mechanical Amplifiers and Filters
Particulate Monitoring
Wireless Sensor Networks/ Sensor Swarms
Mechanical Radio RF Front End
(Acoustic-Mechanical-Electronic Resonating Networks)
Internet of Things Protocol Stacks
Micropower Radio Design

Wireless; RF; “Smart Dust”

BSAC 12-Axis Inertial-Gyro-Magnetic Sensor w/ Radio & Open Source Network Software

Micromechanical RF Channelizer

Fully Integrated Micromechanical Clock Oscillator

Passive Micromechanical Power Converter
Encapsulation and Bonding
Silicon Carbide and Piezo Integration
CMOS Integration of MEMS

Package, Process, Microassembly

P3: Amorphous SiC (Encapsulation)
P2: Poly 3C-SiC (MEMS Structures)
P1: Epitaxial 4H-SiC (SiC Electronics)

Electrode width, \( w \)
Resonator width, \( w \)
Electrode pitch, \( p \)
Aluminum Nitride on CMOS

Silicon Carbide JFET Transistor

* Drawing not to scale

0.2 \( \mu m \), \( N_A \sim 2 \times 10^{19} \) cm\(^{-3} \)
0.3 \( \mu m \), \( N_D \sim 1 \times 10^{17} \) cm\(^{-3} \)
7 \( \mu m \), \( N_A \sim 2 \times 10^{15} \) cm\(^{-3} \)
BioMEMS

Thermal Image of Living Single Cell

Single Cell Surface Enhanced Raman Spectroscopy

Continuous Flow Lysometry

Cell Multi-Culture Array

Continuous Glucose Sensor

Health Care

Drug Delivery Systems

Micro Cellular Assays

Immunoassays & Medical Devices

Neural Interfaces
UC Berkeley

Top Public U.S. University
Access to
Lawrence Berkeley National Laboratory
High Tech SanFrancisco Bay Area
(Silicon Valley / Venture Capital of U.S.)
Gateway University to Asia