DESIGN, FABRICATION AND CHARACTERIZATION OF CMOS ISFET FOR pH MEASUREMENTS

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DESIGN, FABRICATION AND CHARACTERIZATION OF CMOS ISFET FOR pH MEASUREMENTS

by

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List of Abbreviations

Al	Aluminium
Al_2O_3	Aluminium Oxide
Ag/AgCl	Argentum/ Argentum Chloride (Silver/Silver Chloride)
BSC	Back sided contact
BOE	Buffered Oxide Etch
Ca^{2+}	Calcium ion
ChemFET	Chemically modified field effect transistor
CMOS	Complementary Metal Oxide Semiconductor
CAD	Computer Aided Design
I-V	Current-Voltage
DIW	Deionised Water
DUT	Device Under Test
DC	Direct Current
FET	Field Effect Transistor
FIA	Flow injection analysis
HDL	Hardware Description Language
H^+	Hydrogen ion
IGFET	Insulated Gate Field Effect Transistor
ISE	Ion sensitive electrode
ISFET	Ion Sensitive Field Effect Transistor
K^+	Kalium ion
Hg	Mercury
Hg_2Cl_2	Mercury Chloride

MIS	Metal Insulator Semiconductor
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
MNOS	Metal-nitride-oxide-semiconductor
MFCL	Micro Fabrication Cleanroom Laboratory
µTAS	Micro total analysis system
Na^+	Natrium ion
NMOS	N-channel MOSFET
O_2	Oxygen (gas)
PMOS	P-channel MOSFET
PVD	Physical Vapour Deposition
PECVD	Plasma Enhanced Chemical Vapour Deposition
pCO_2	Power of carbon dioxide
pH	Power of hydrogen
PCB	Printed Circuit Board
QC	Quality control
RE	Reference Electrode
rpm	Revolution per minute
SCE	Saturated Calomel Electrode
SCS	Semiconductor Characterization System
SPA	Semiconductor Parameter Analyzer
Si	Silicon
SiO_2	Silicon dioxide or Silicon oxide or Oxide
Si_3N_4	Silicon Nitride
SPICE	Simulation Program With Integrated Circuit Emphasis
SnO_2	Stanum oxide

Ta_2O_5	Tantalum penoxide
TCAD	Technology Computer Aided Design
TAT	Turn around time
VHDL-AMS	Very-High-Speed-Integrated-Circuit Hardware Description Language (VHDL)-Analog and Mixed Signal (AMS)

List of Symbols

Symbol	Description	Unit
I_D	Drain current	A
V_D	Drain voltage	V
V_G	Gate voltage	V
V_{TH}	Threshold Voltage	V
b	Width of Area	µm
L	Length of Area	µm
μ_n	Electron mobility in a channel	
C_0	Oxide capacitance per unit area	F/m^2
V_{DSAT}	Drain voltage at saturation	V

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List of Publications

[1] U. Hashim and S. F. Chin, "Simulation of NMOS in Standard CMOS Process using Synopsys' TSUPREM-4 and MEDICI," in *Malaysian Technical Universities Conference on Engineering and Technology (MUCET)*, Universiti Teknologi Tun Hussein Onn, 2006, pp. 36-39.

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[9] U. Hashim, S. F. Chin, and S. Sakrani, "Application of Synopsys' Taurus TCAD in Developing CMOS Fabrication Process Modules," *International Journal of Nanoelectronics and Materials,* vol. 2, pp. 1-10, 2009.

List of Awards

1. Research and Innovation Awards 2009 **Gold** Medalist

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