A DISSERTATION ON

Simulation and Analysis of Pentacene Based Field Effect Transistor

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF

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SUBMITTED BY

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CERTIFICATE

This is to certify that the dissertation entitled ***"Simulation and Analysis of Pentacene based Field Effect Transistor"*** is the authentic work of Mr. Nishant under my guidance and supervision in the partial fulfilment of requirement towards the degree of Master of Technology run by the Department of Applied Physics in Delhi Technological University.

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DECLARATION BY THE CANDIDATE

I hereby declare that the work presented in this dissertation entitled "**Simulation and Analysis of Pentacene based Field Effect Transistor**" has been carried out by me under the guidance of Prof. S.C.Sharma, HOD, Department of Applied Physics, Delhi Technological University, Delhi and hereby submitted for the partial fulfilment for the award of degree of Master of Technology in Nanoscience and Technology at Applied Physics Department, Delhi Technological University, Delhi.

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ABSTRACT

This study represents the variation in contact length in top contact OFET geometry and channel length variation in bottom contact OFET geometry, software simulations were performed on ATLAS and observed the I_d-V_g characteristics .Higher contact length reduces contact resistance but large contacts greatly increase the device size and consume more contact material. Parameters use in the structure of the OFET are length of the device is 90 micro meter. Width of the gate is 20 nano meter and material used is aluminium, width of the gate oxide is 300 nano meter material used is SiO_2, organic material is pentacene thickness of pentacene is 100 nano meter, source and drain thickness is 20 nano meter length is varied over 10 micro meter to 40 micro meter in bottom contact and 10micro meter to 30 microm in top contact geometry. Both the case top contact and bottom contact the parameters are same. As shown in the figure that increasing the contact length the value of drain current is increased. Drain current increases with increasing the contact length but in contact length 10µm and less drain current value is very low. Therefore contact length is greater than 10µm. Best suitable contact length for top contact geometry is 30µm. In bottom contact the variation in channel length 10µm and 20µm shows abnormal characteristic because in bottom contact the charge injection area is near the contact current crowding is more if channel length is small. Best suitable channel length for bottom contact is 30µm. Lc is the length of the source and Lco is the characteristic length Rs is the source resistance Rch is channel resistance. The influences of the contact length (L_C) on the contact resistance (Rsd = Rs + Rd) and the channel resistance (Rch) . At a small V_G , Rsd decreases slightly upon expanding L_C whereas more than 60% decrease in Rsd can be obtained at high V_G.Over the critical length L_{C0}=0.6µm,further expanding increases the parasitic capacitance that will adversely affect the performance.

In OFET organic semiconductor used in the simulation is pentacene which is a p-type semiconductor. It works in the accumulation mode. When gate voltage and drain voltage is applied. This simulation is done with ATLAS. ATLAS is simulation software.

In this project work variation in the contact length is observed. How small contact can be obtained. Contact material used in OFET is Au. So to reduce the cost contact must reduce.