renders OFETs as a promising candidate for sensor devices, particularly electronic nose applications.

The fabricated OFET device presents high charge carrier mobility and an enhanced sensor response at a low detection limit with fast response and recovery time. The device operated reliably at ambient air, found to be highly selective and cost-effective. Taking these facts into account, it can be concluded that the PANi-Ta_2O_5-CSA based OFET is a promising platform for developing small-sized, low-cost, stable NO_2 gas sensors operable at room temperature.

5.2 Future scope of the work

The present thesis demonstrates room-temperature operable NO_2 gas sensor based on chemiresistive and OFET configurations. The OFET based sensor showed superior performance compared to the chemiresitive counterpart and is preferred for the gas sensing applications.

Compared to the two-electrode chemiresistors, the structure and operation of OFETs are more complex. The formation of the conducting channel at the semiconductor/dielectric interface is induced by the gate voltage and this enables to use ultrathin films of a wide variety of nanostructures as the active layer in the OFETs. The charge accumulation layer induced by the gate bias makes OFETs scalable and highly sensitive. Also, the enormous potential of using nanostructured thin films which facilitates high rate of adsorption/desorption and capture of analyte molecules with short response/recovery time opens up the road to use miniaturized, low-power yet high-performance sensor applications.

It is believed that the next-generation will strive for portable, small-sized, low power sensor devices. Therefore, there has been a constant demand for the development of low-voltage OFETs in the gas sensing field. However, it is a challenging task to obtain high performance OFETs with low voltage operability at the same time.

As the present device shows high charge carrier mobility, excellent gas sensitivity, good selectivity and air stability, there is ample scope to utilize the sensor in high-performance applications such as electronic nose devices. With further research on material engineering to fine tune the PANi based semiconductor and the gate dielectric with reduced thickness, low

power operation and longer life time can be achieved. This will facilitate integrating the sensor device in low-cost, battery-operated portable circuits for continuous and effective monitoring of the environmentally toxic gas.

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