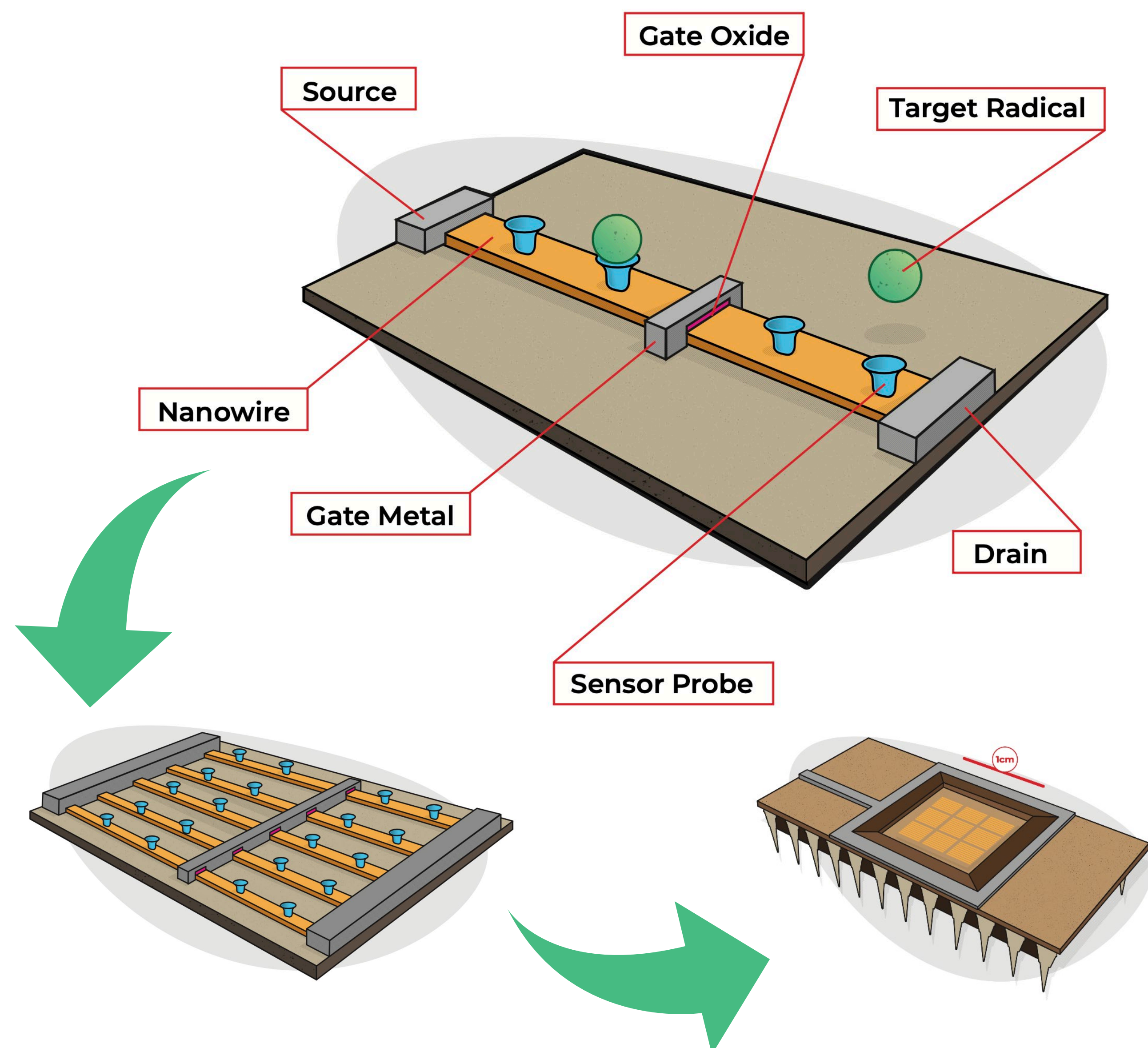


### 1. RADICAL: A novel electronic sensor for atmospheric radicals

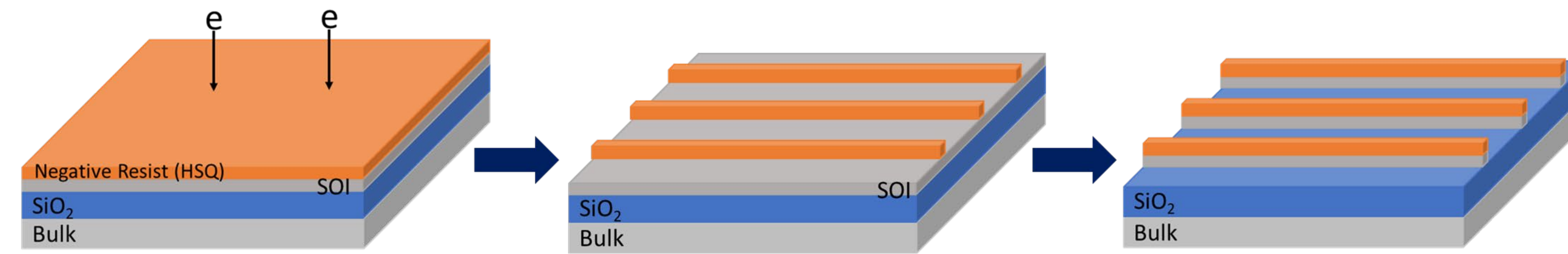
**Atmospheric radicals** like  $\cdot\text{OH}$  and  $\cdot\text{NO}_3$  dominate the chemistry of the air we breathe, but remain difficult to detect in real-life environments.

Silicon junctionless nanowire transistors (JNTs) have shown promising sensing abilities in liquid phases but not yet in **gas phase**.

Here we present the first steps towards building an **electronic nose** for detecting atmospheric radicals, based on an array of JNTs.



### 2. Top-down Si Nanowire Fabrication



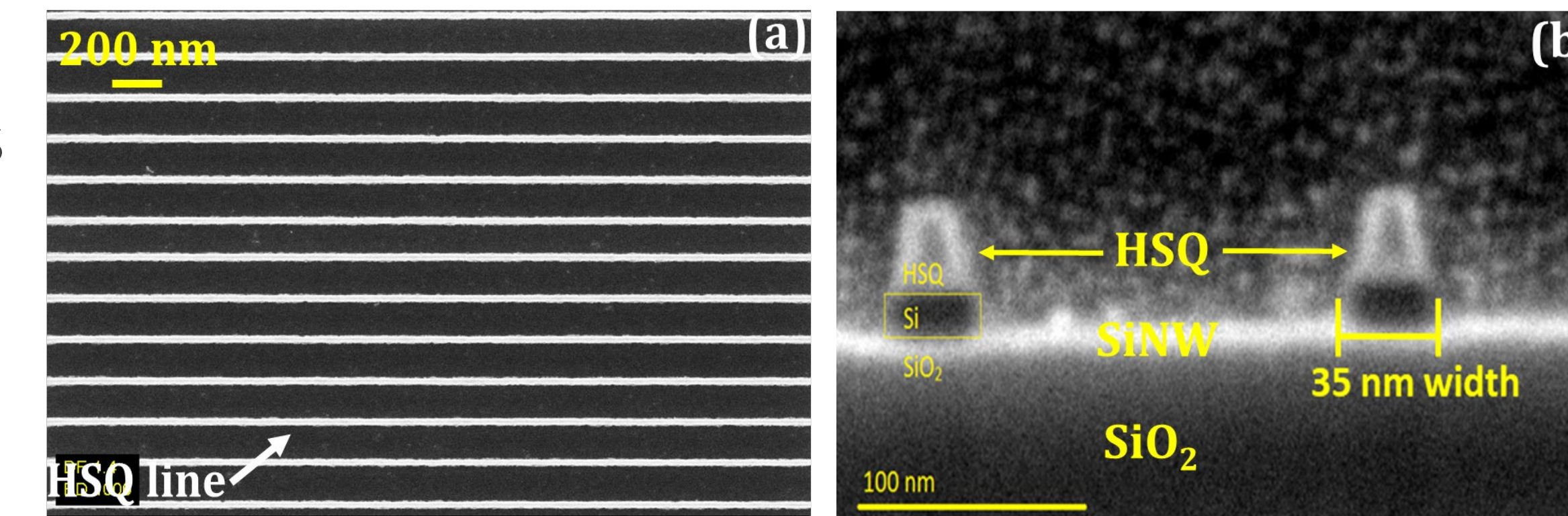
Electron beam lithography (EBL)

Resist Development

Dry Etching (ICP-RIE)

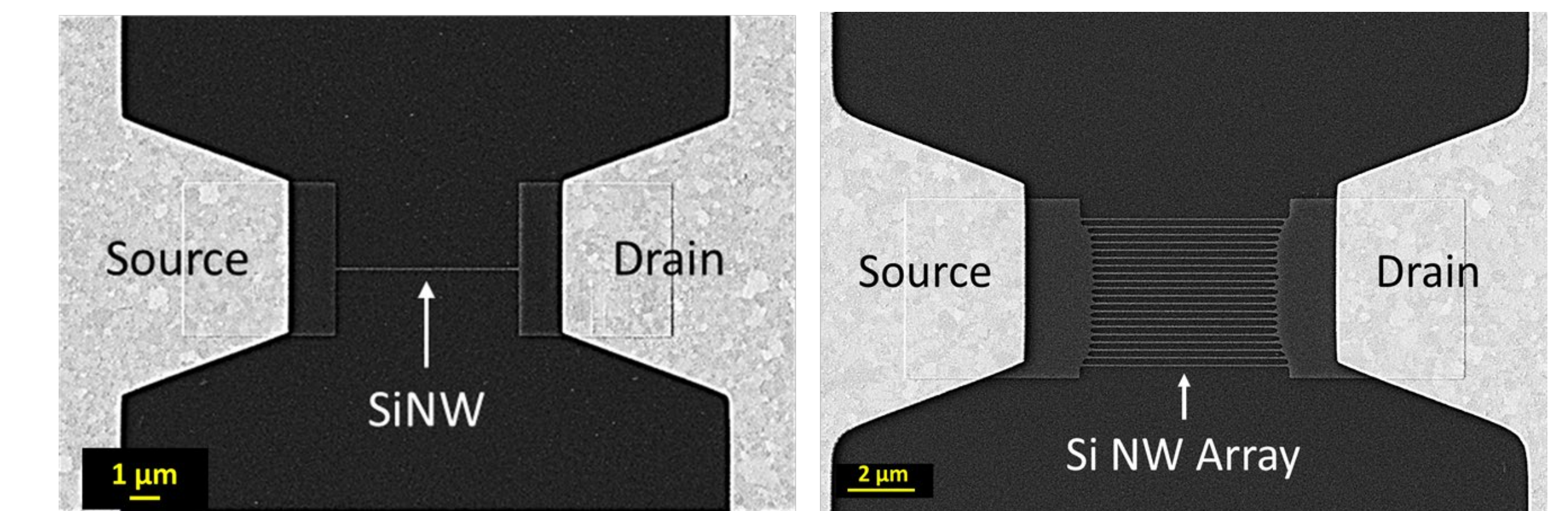
(a) Top view SEM images of HSQ lines attained by EBL

(b) Cross-section of silicon nanowires (Si NW): HSQ patterns are transferred into Si layer using ICP-RIE



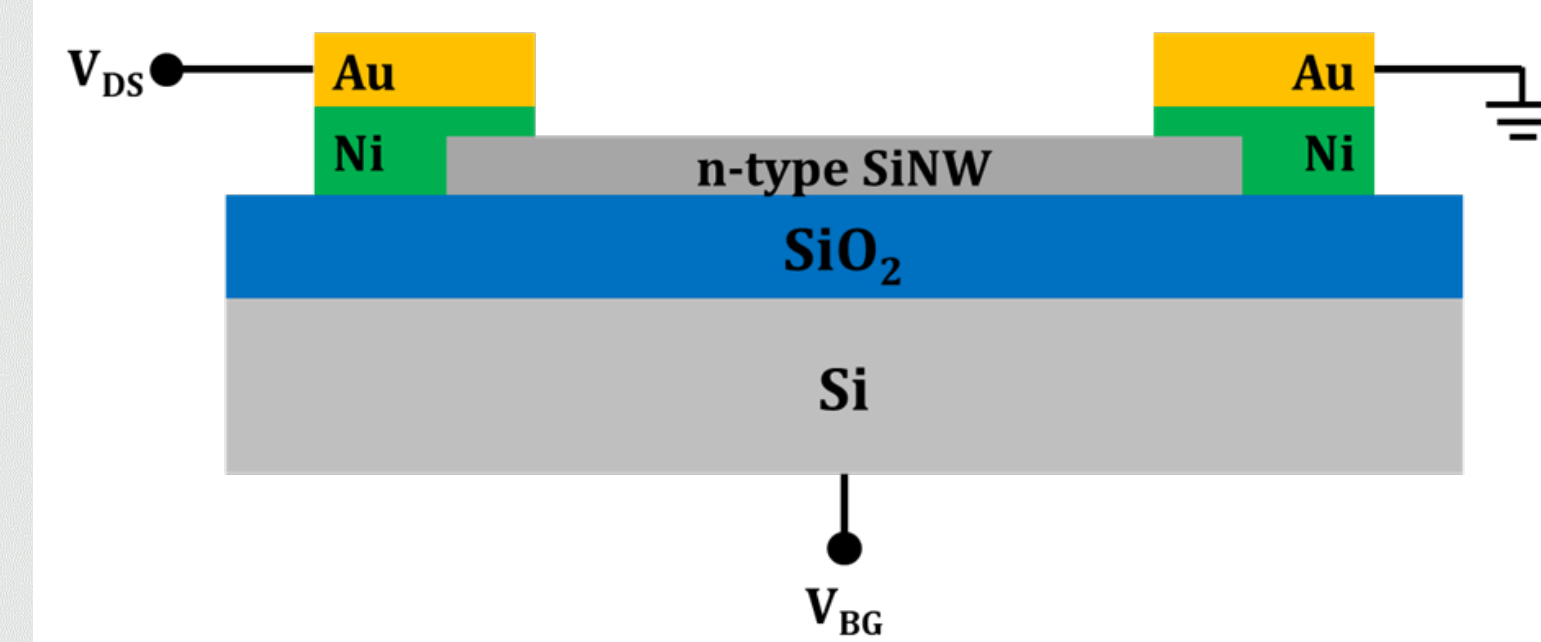
### 3. Source Drain Contact Formation

Contact patterning by PMMA resist coating and EBL. Metal deposition by e beam evaporation and lift-off. Metals used – 20 nm Nickel and 140 nm Gold.



Top view SEM image of JNT devices

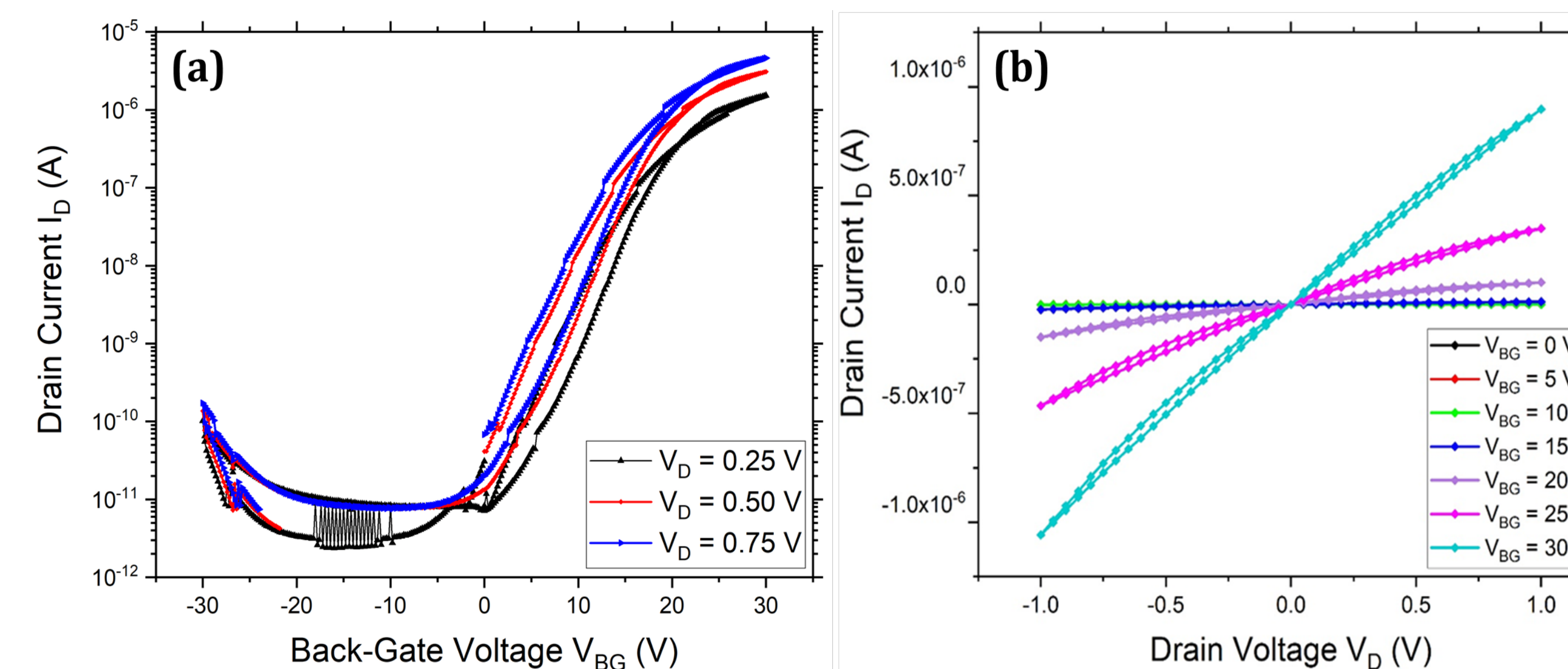
### 4. Electrical Characteristics



#### Back-gated electrical results

(a) Transfer characteristics showing Drain Current  $I_D$  vs Back-Gate Voltage  $V_{BG}$  for  $V_D = 0.25$  V,  $0.50$  V, and  $0.75$  V. The curves show a minimum current around  $V_{BG} = 0$  V.

(b) Output characteristics showing Drain Current  $I_D$  vs Drain Voltage  $V_D$  for various back-gate voltages  $V_{BG}$  from 0 V to 30 V. The curves show a linear relationship between  $I_D$  and  $V_D$ .



### 5. Outlook: Atmospheric Radical Sensing

#### Next steps

A comprehensive range of sensor performance tests within atmospheric simulation chambers and outdoor urban environments.



#### Future

A low-cost electronic sensor for atmospheric radicals and other gases

Find out more and follow our progress:

e: [info@radical-air.eu](mailto:info@radical-air.eu)  
w: [www.radical-air.eu](http://www.radical-air.eu)  
t: @radical\_air  
in: radical-air

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