Chemistry in Semiconductor

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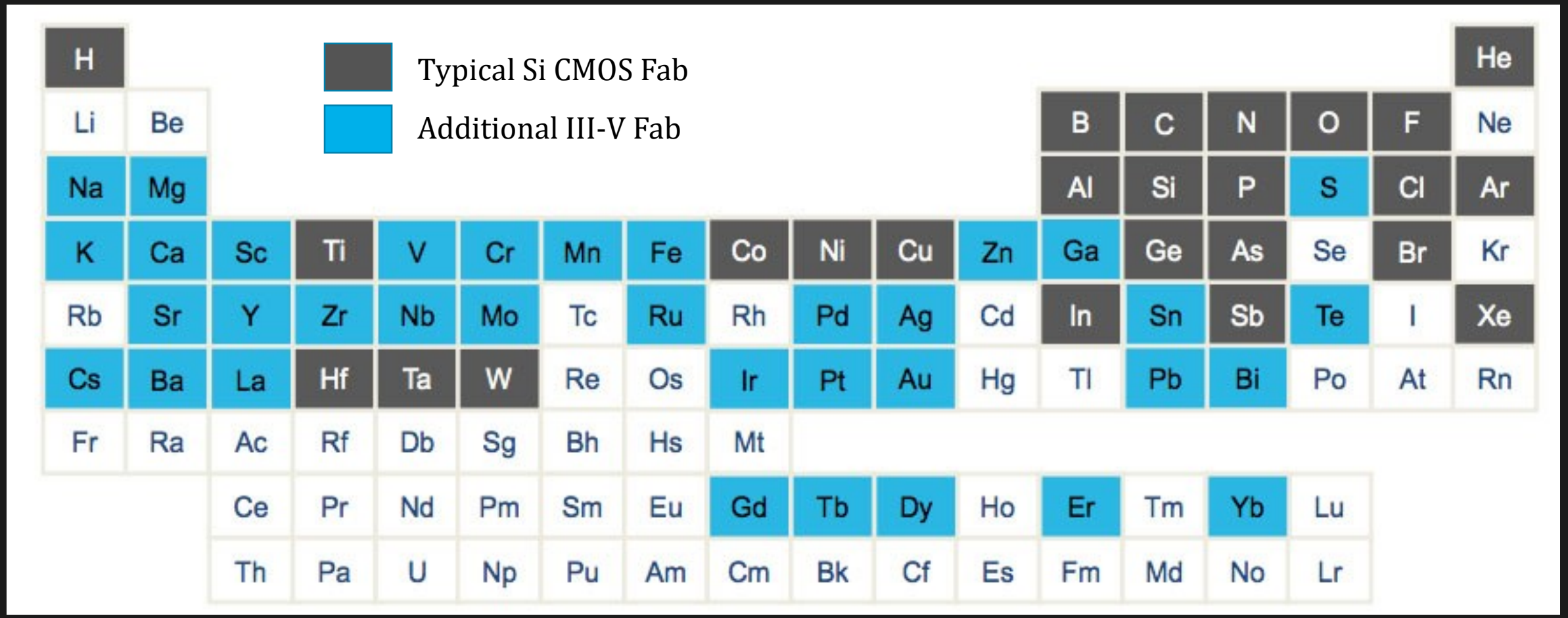
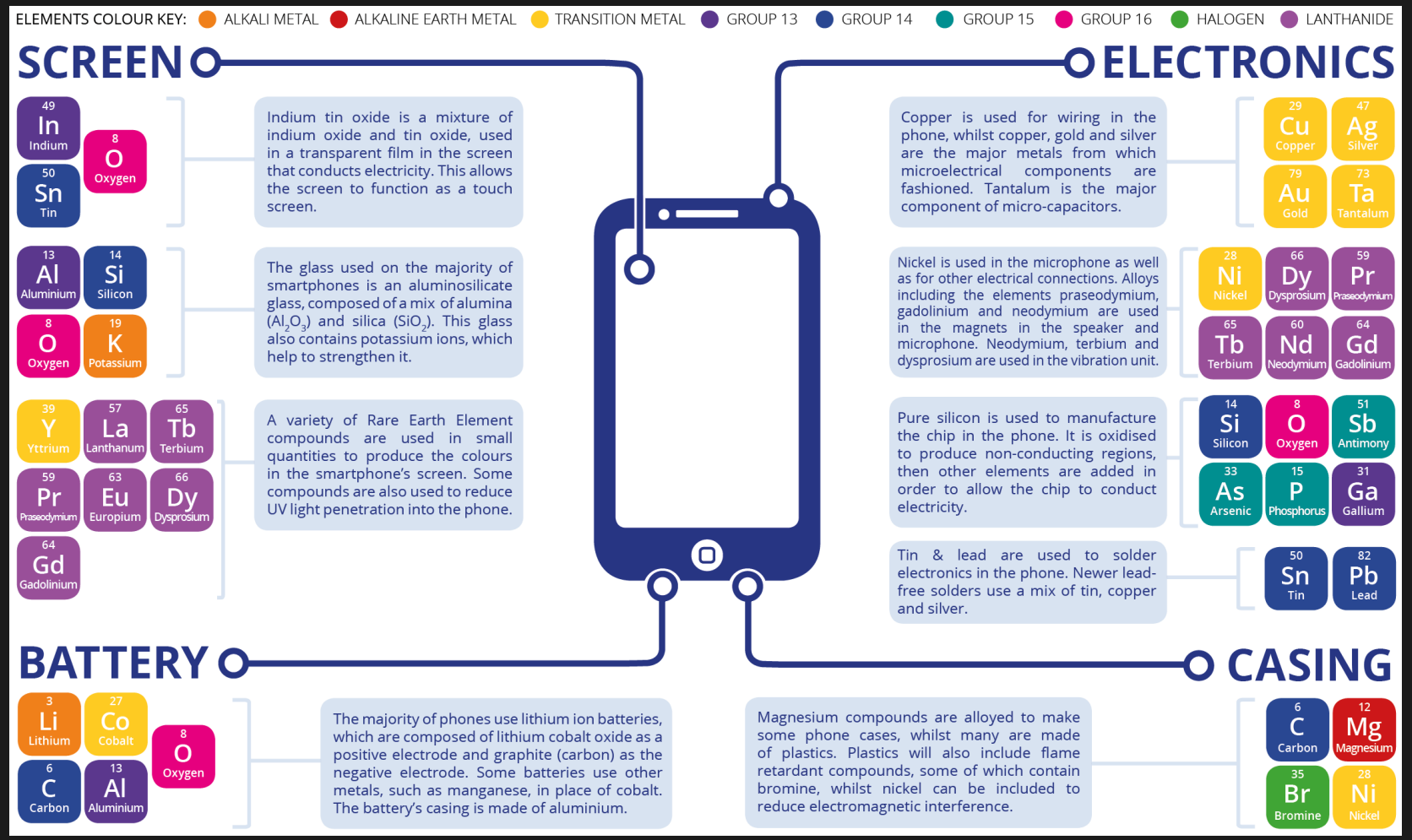
Outline

- Elements used in semiconductor industry
- Evolution and Revolution of Transistors
- More Moore vs. More than Moore
- Carbon chemistry era
- Academia-Industry Collaboration
- How ACS journal help us to resolve issue ?
- Summary

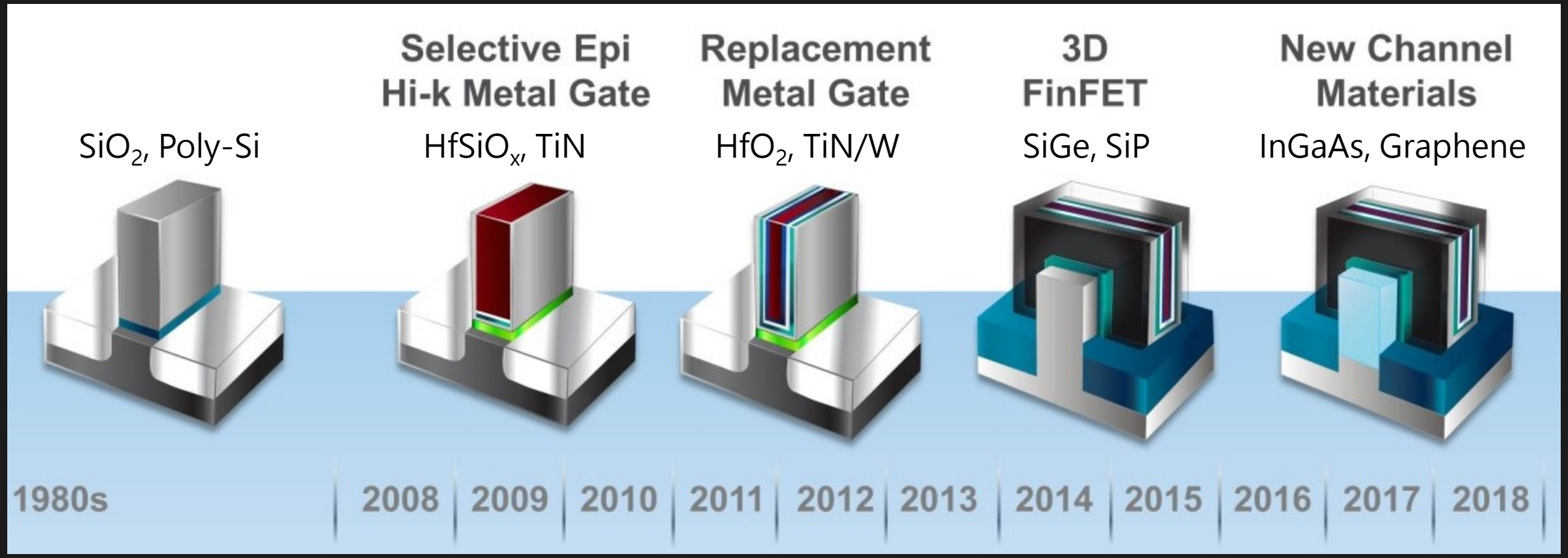
Elements Used in Semiconductor Industry



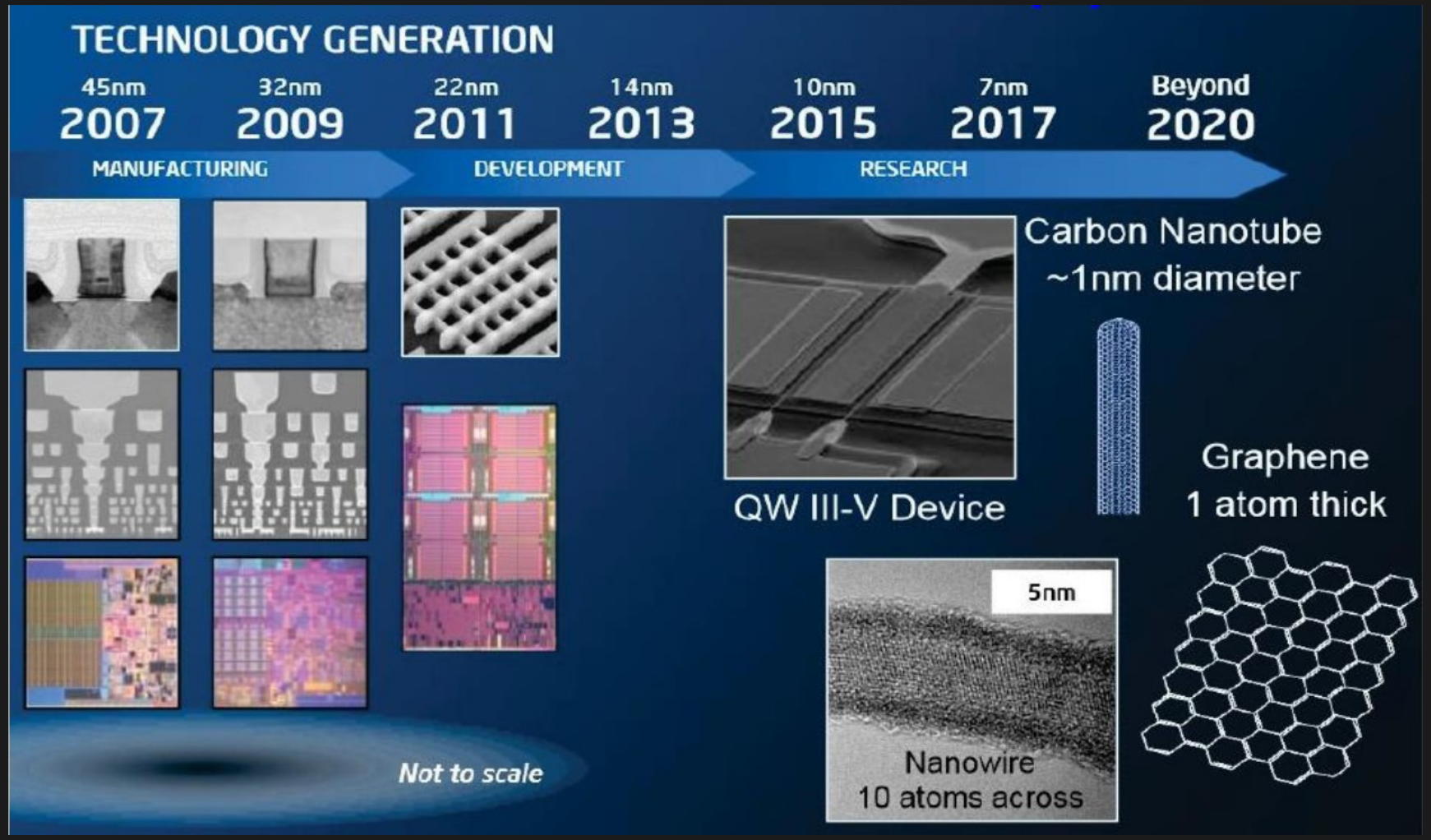
Elements of A Smartphone



Evolution of Transistors

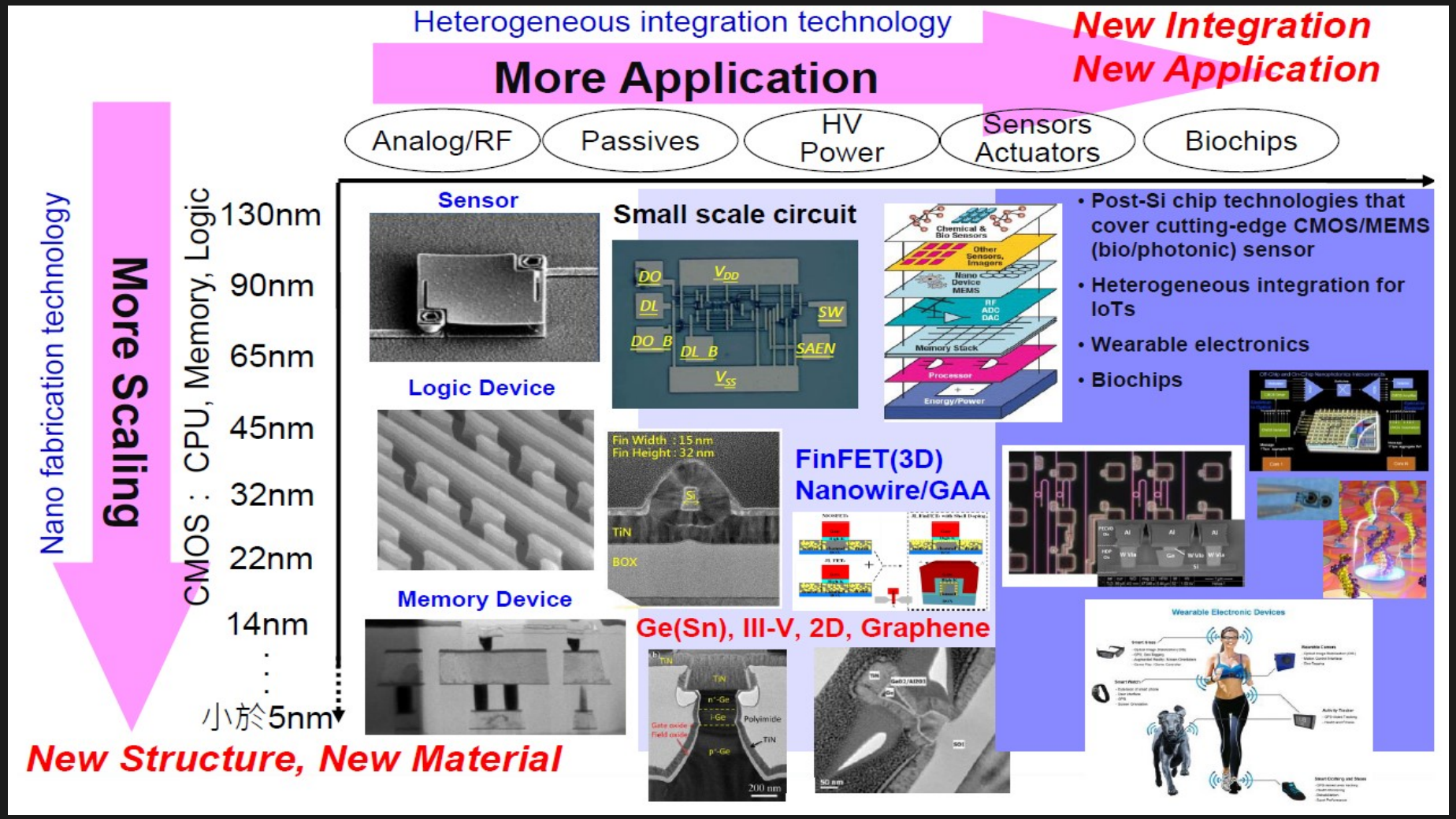


Revolution of Transistors

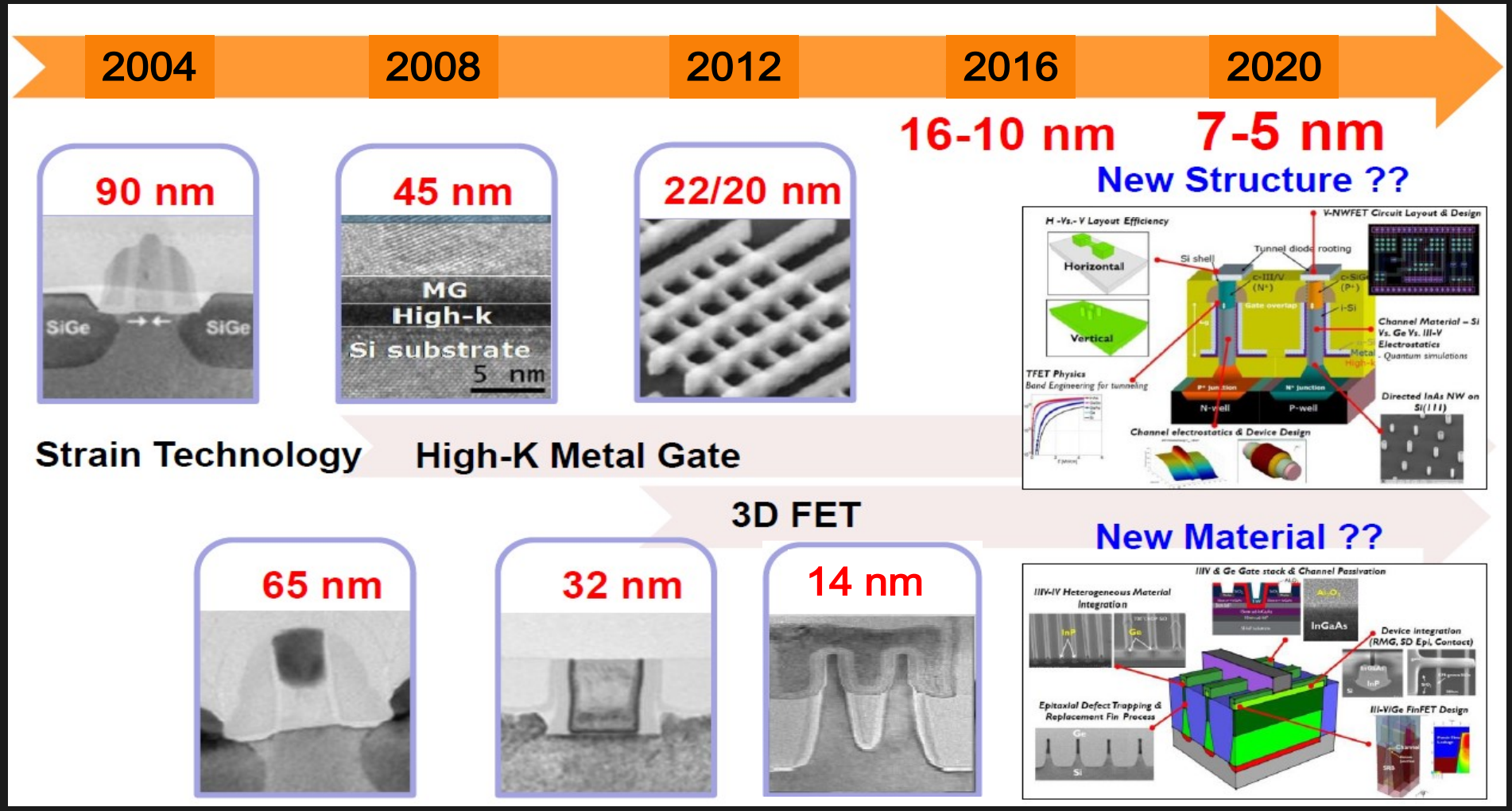


The iPhone Evolution

More Moore vs. More than Moore

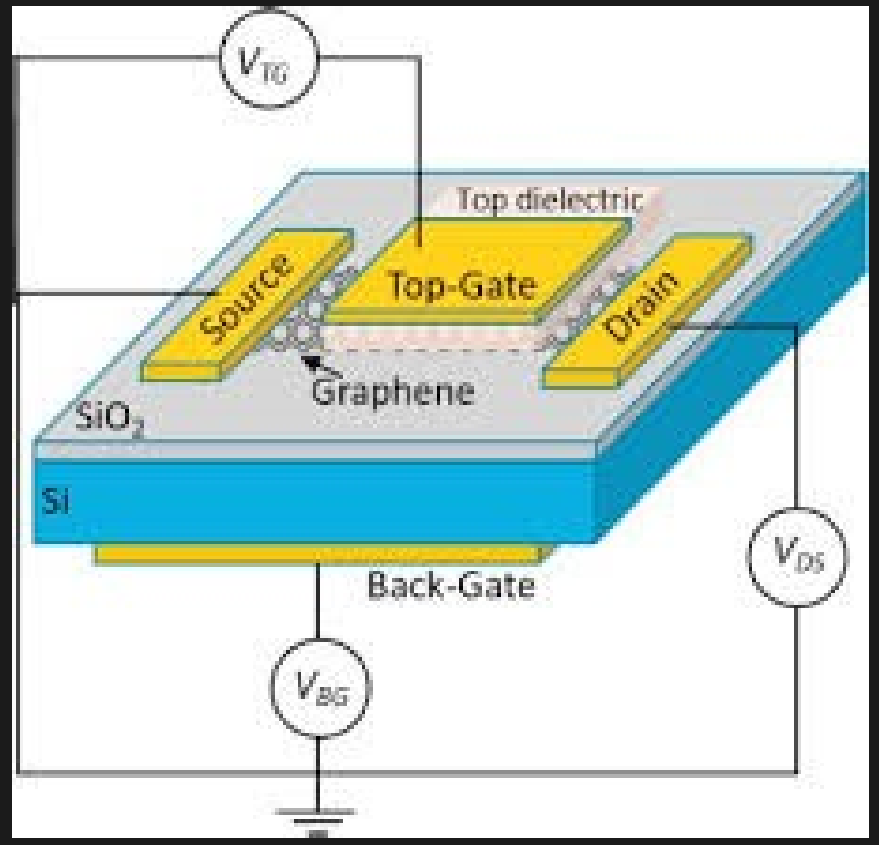


Logic Device Trend

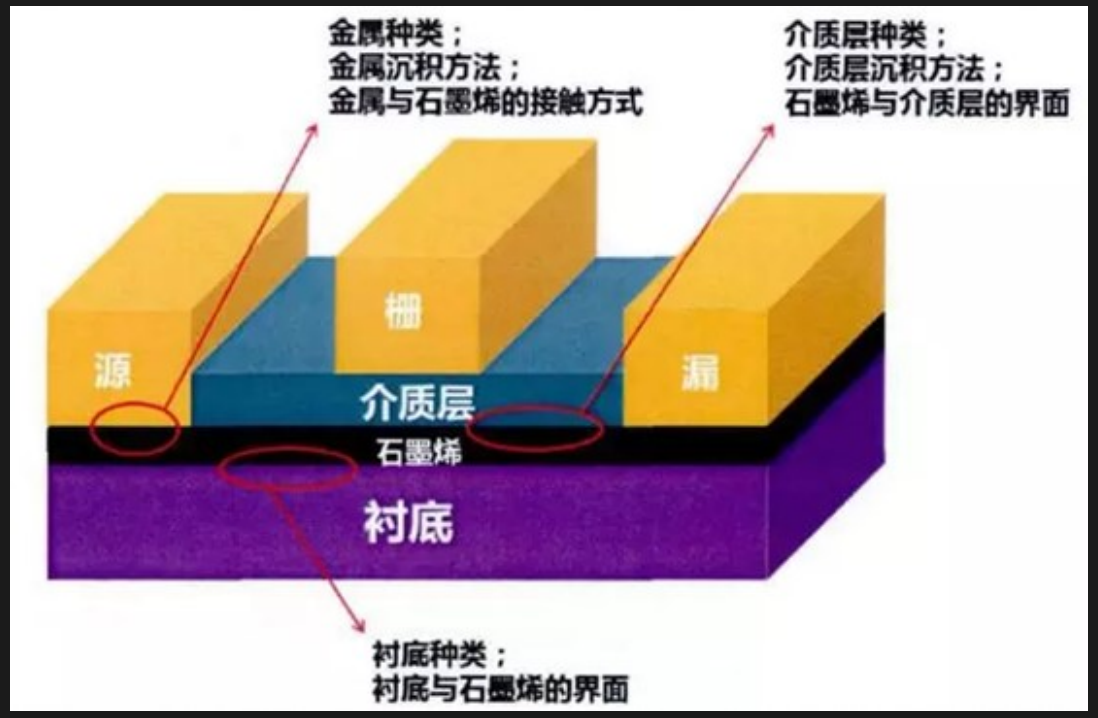


Carbon Chemistry Era

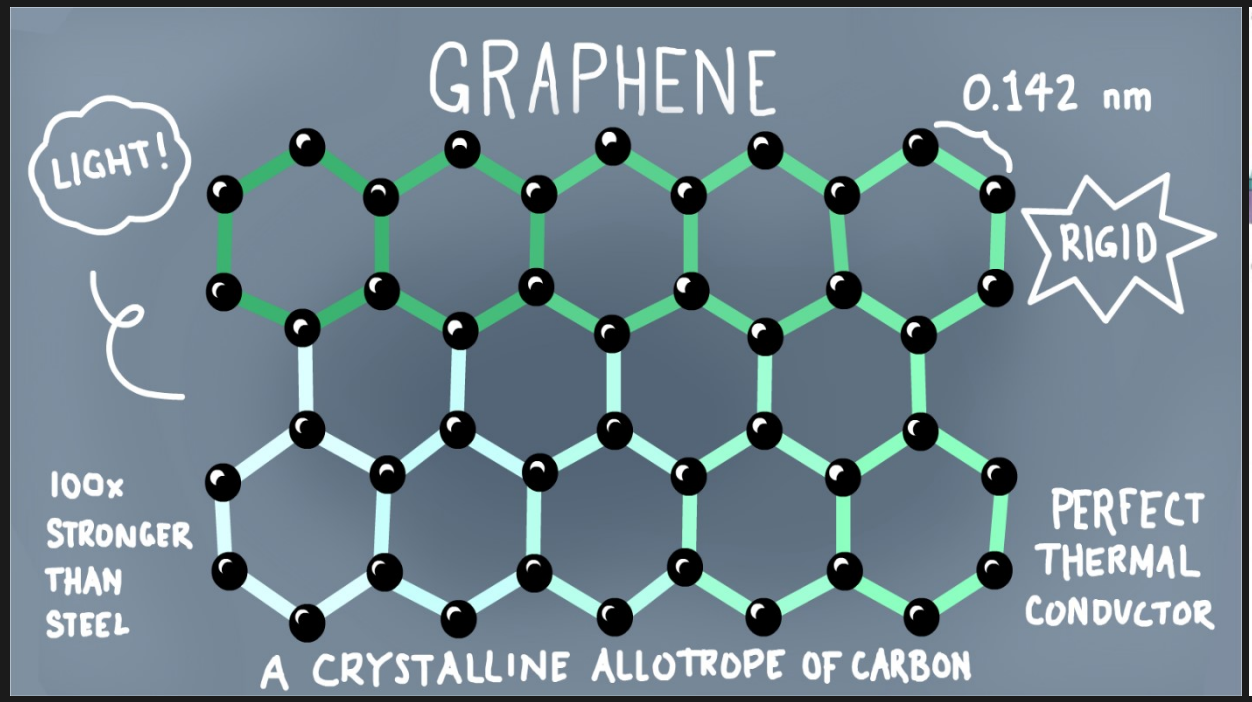
Si ➔ Ge ➔ III-V ➔ 2D / Graphene

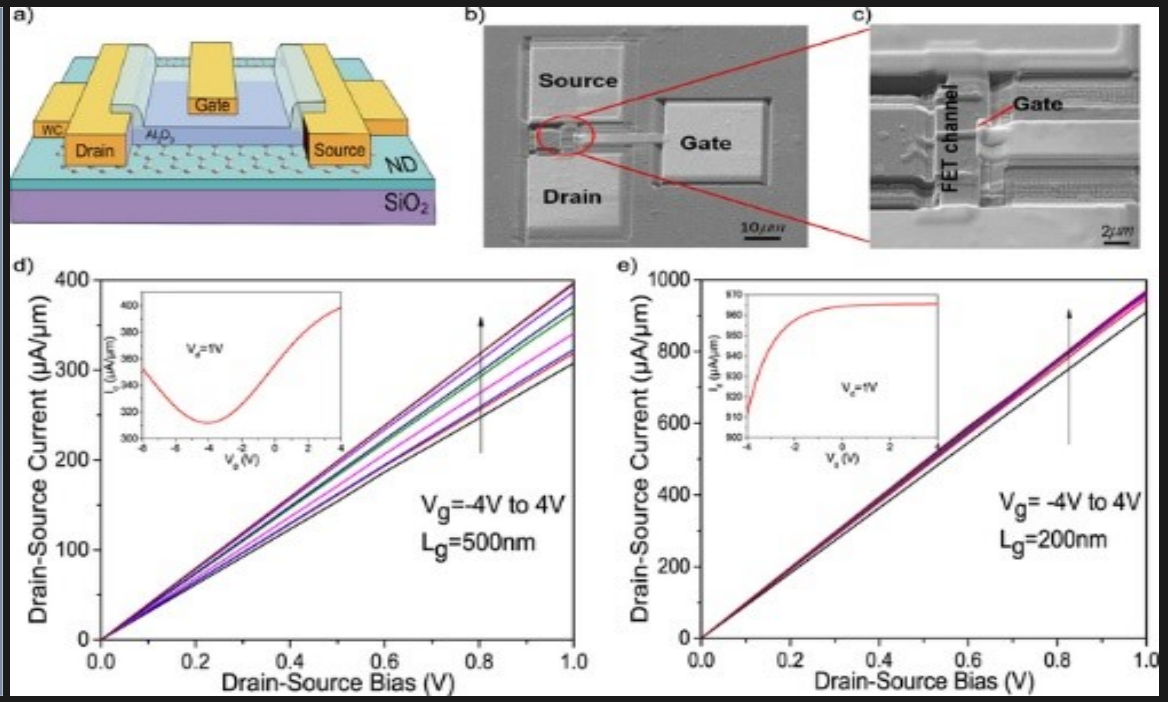


Channel	Electron Mobility (cm^2/Vs)	Energy Bandgap (eV)
Si	1,400	1.12
Ge	3,900	0.67
GaAs	9,200	1.43
CNT	100,000	0.5
Graphene	200,000	0



Why Graphene Enables Transistor?





Academia-Industry Collaboration

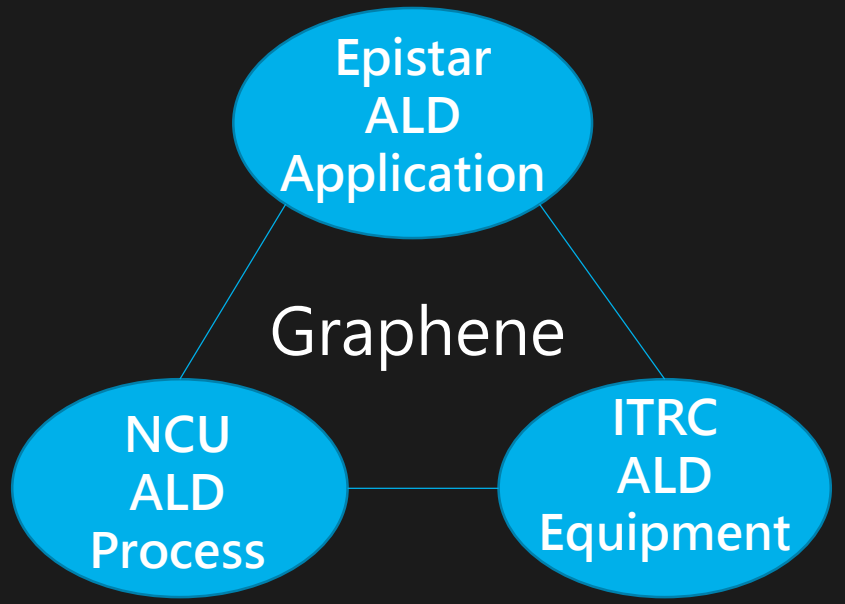
[媒體報導]晶電、儀科中心攜央大 共創綠能新科技
資料來源：聯合財經網　刊登日期：2014-09-24

晶電、儀科中心攜央大 共創綠能新科技

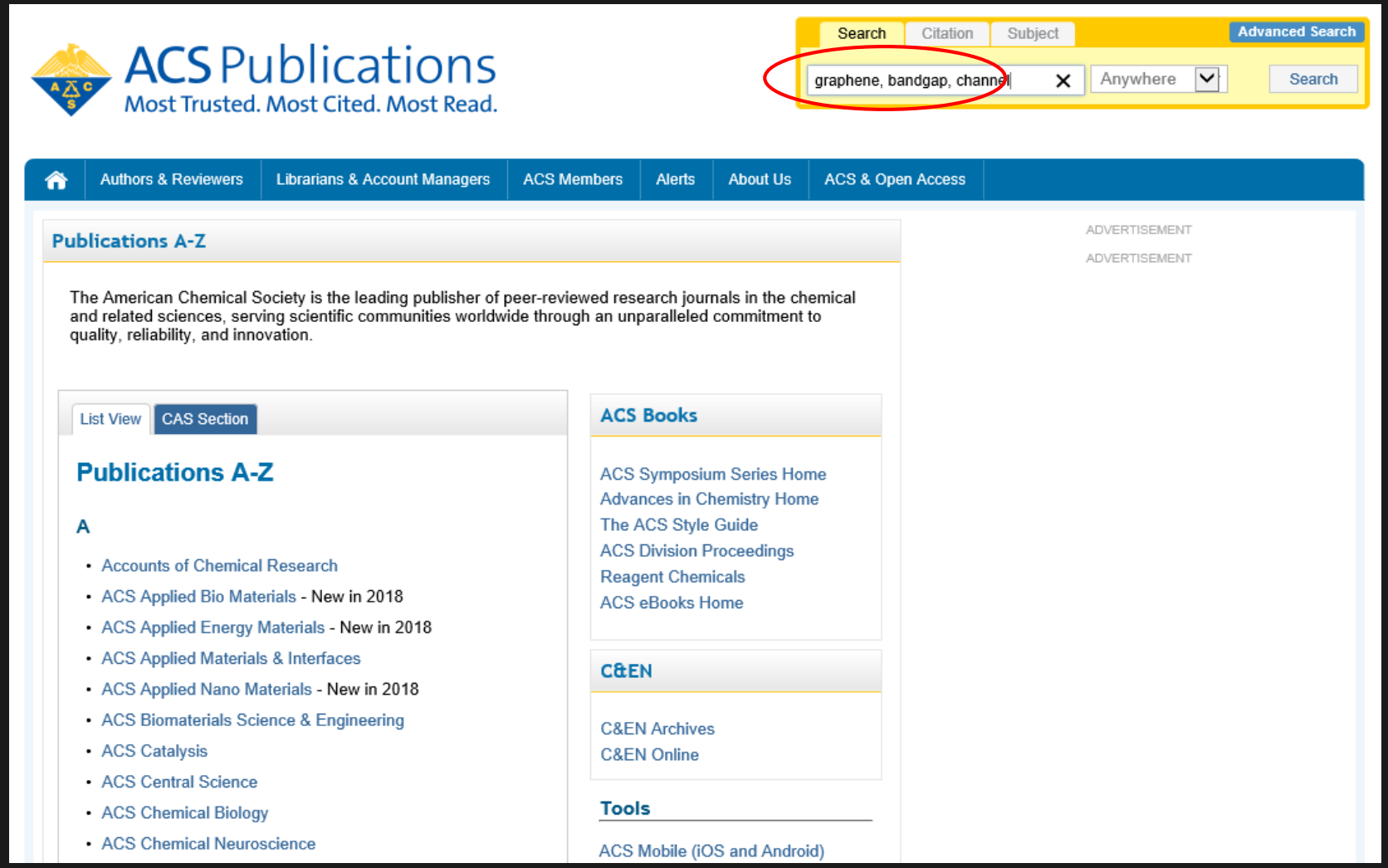
2014-09-23 經濟日報 記者李珣瑛/即時報導

為推動我國綠能科技發展，國研院儀科中心「光學系統整合研發聯盟」主導結合全球最大LED晶片廠晶元光電、中央大學薄膜技術中心以及儀科中心等產學研三方能量，將先進材料石墨烯應用於紫外光發光二極體 (UV-LED)的製造技術，預期可提升台灣UV-LED製造技術水準，達到與美、日大廠並駕齊驅的境界，推估可有超過3.6億元以上的年產值。

Relationship



How ACS Journal Help Us to Resolve Issue ?



Searching Result

Sub-100 nm Channel Length Graphene Transistors

Lei Liao, Jingwei Bai, Rui Cheng, Yung-Chen Lin, Shan Jiang, Yongquan Qu, Yu Huang, and Xiangfeng Duan

Nano Lett., **2010**, *10* (10), pp 3952-3956

Publication Date (Web): September 3, 2010 (Letter)

DOI: 10.1021/nl101724k

Here we report high-performance sub-100 nm channel length graphene transistors fabricated using a self-aligned approach. The graphene transistors are fabricated using a highly doped GaN nanowire as the local gate with the source and drain electrodes ...

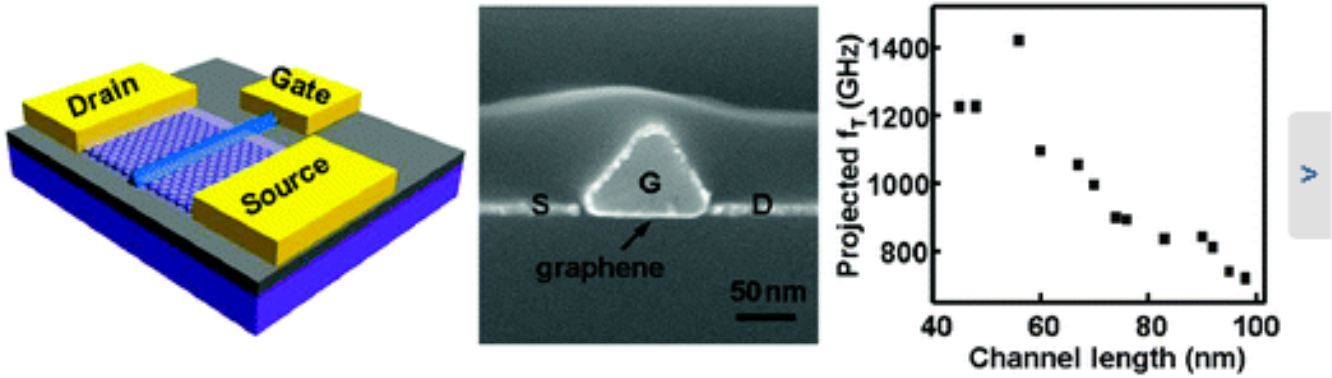


Figure 1 of 5

Abstract | Supporting Info

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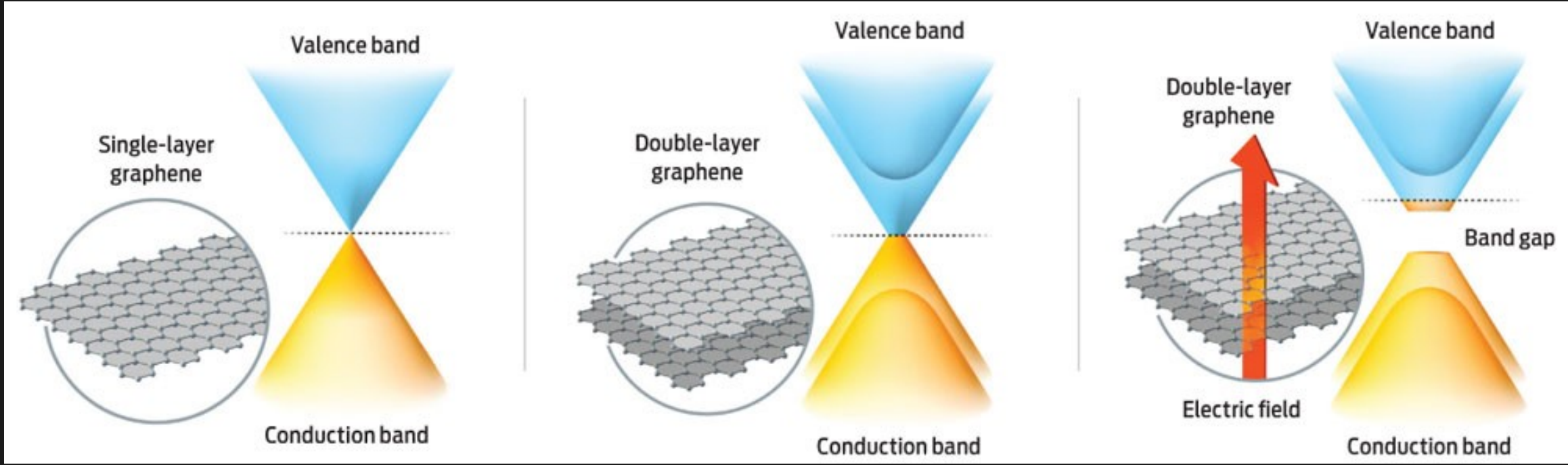
Alternative Way for Tunable Bandgap



Summary

For More Moore

- Scaling technology is more and more tough, especially for EUV lithography process.
- New material and new structure are necessary to keep Moore’s law on-going.

For More than Moore

- New thinking for specific application can be more flexible to create new market.
- Technology needs to be compatible with Si-base IC technology and low cost.