

# Applications of 2D Materials Beyond Graphene

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## 1. Introduction & Beginnings

### (a) Before graphene

- i. Prior to the mid-1980s (1985) graphite had been used for several practical applications. In 1985 the discovery of Fullerenes fueled expansion of research on the material and its derivatives [2, 3]
- ii. Theories suggested the possibility of one-dimensional structures of this form, and carbon nanotubes (1991) [1]. This suggested the possibility of synthesizing carbon structures on a larger scale than was previously possible with fullerenes.
- iii. In 2004 single layers of graphite were isolated by Geim et. al [4, 5]. This breakthrough led to a breadth of literature on graphene surfaces and its possible applications.

### (b) After Graphene: Emergence of other 2D materials

i.

## 2. Comparisons to 2D materials to Graphene

### Notes from class overview

1. TMDs
2. Compare 2D materials to properties of graphene
3. Why are 2D material significant
  - (a) Electronic device applications
4. Fundamental materials
5. State of the art (“cutting-edge”)
6. Problems/Outlook:  
Contacts, interface, controlled doping, etc...

## References

- [1] Sumio Iijima. Helical microtubules of graphitic carbon. *Nature*, 354:56–58, 1991.
- [2] H. W. Kroto, J. R. Heath, S. C. O’Brien, R. F. Curl, and R. E. Smalley. C60: Buckminsterfullerene. *Nature*, 318:162–163, 1985.
- [3] Ruben Mas-Balleste, Cristina Gomez-Navarro, Julio Gomez-Herrero, and Felix Zamora. 2d materials: to graphene and beyond. *Nanoscale*, 3:20–30, 2011.
- [4] K. S. Novoselov, A. K. Geim, S. V. Morozov, D. Jiang, Y. Zhang, S. V. Dubonos, I. V. Grigorieva, and A. A. Firsov. Electric field effect in atomically thin carbon films. *Science*, 306(5696):666–669, 2004.
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