FLAG–ERA JTC 2019 Project

2D-Material Heterostructure NEMS Sensors (2D-NEMS)

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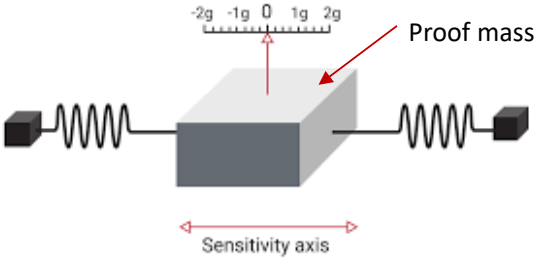
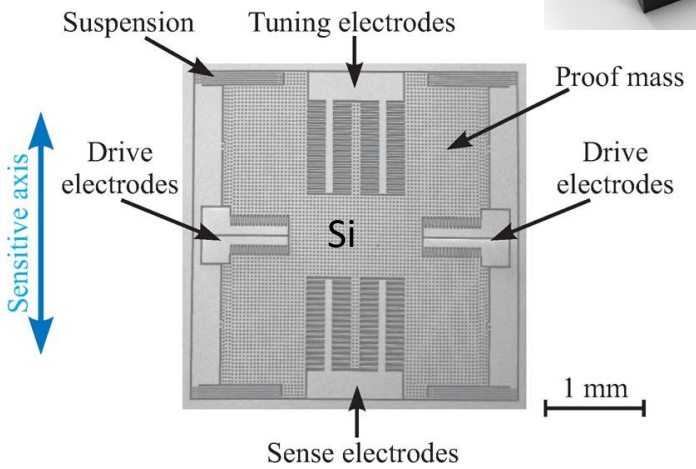
Motivation behind 2D-NEMS

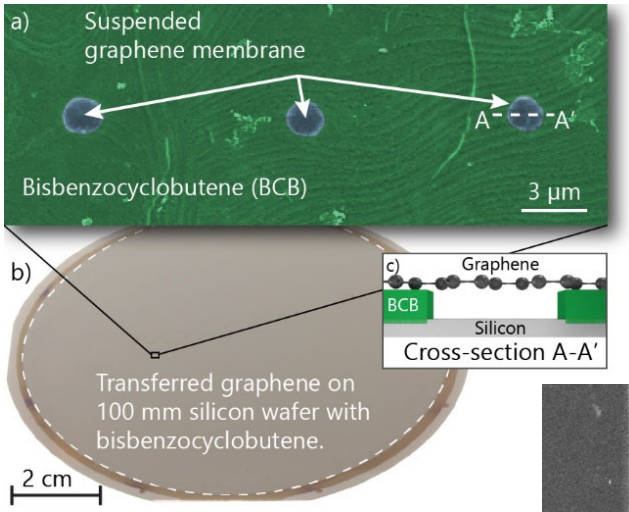
Conventional MEMS sensor





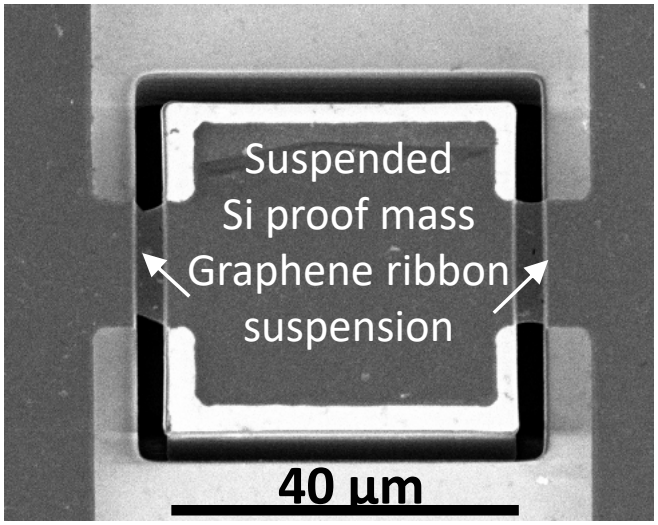
Further miniaturization is hampered by limitations of current Si-based materials.

2D material approach



2D material heterostructures can increase sensitivity and thus enable smaller and cheaper sensors.

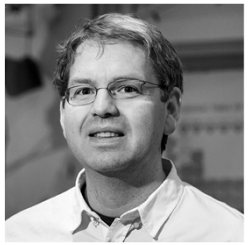
Top view



Objectives of 2D-NEMS

1. Realization and electromechanical characterization of suspended 2D material heterostructures with attached proof masses.
2. Exploration and evaluation of scalable integration technologies for realizing suspended 2D material heterostructures.
3. Realization of NEMS sensor concepts based on suspended 2D material heterostructures and their performance characterization.

2D-NEMS consortium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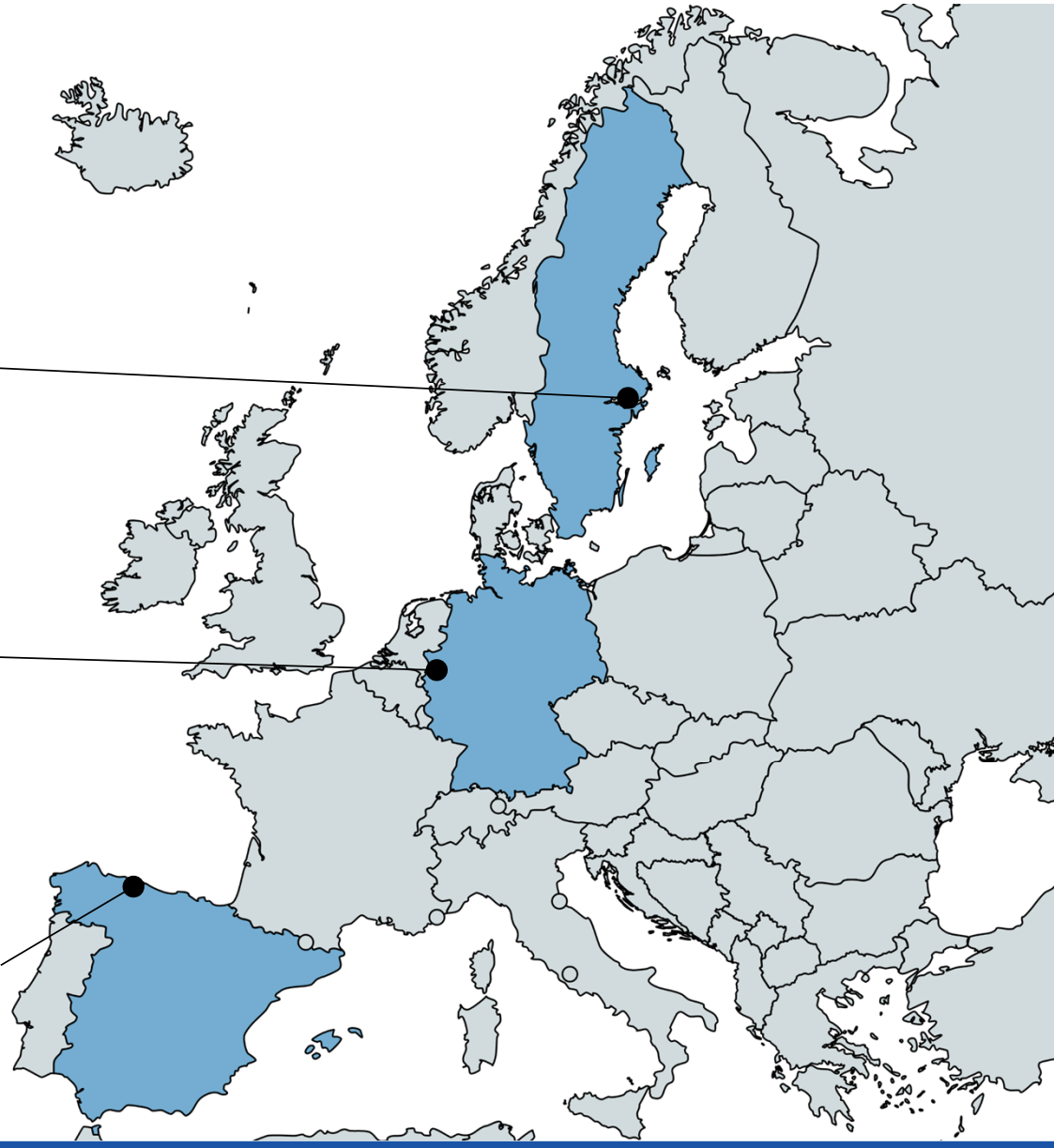
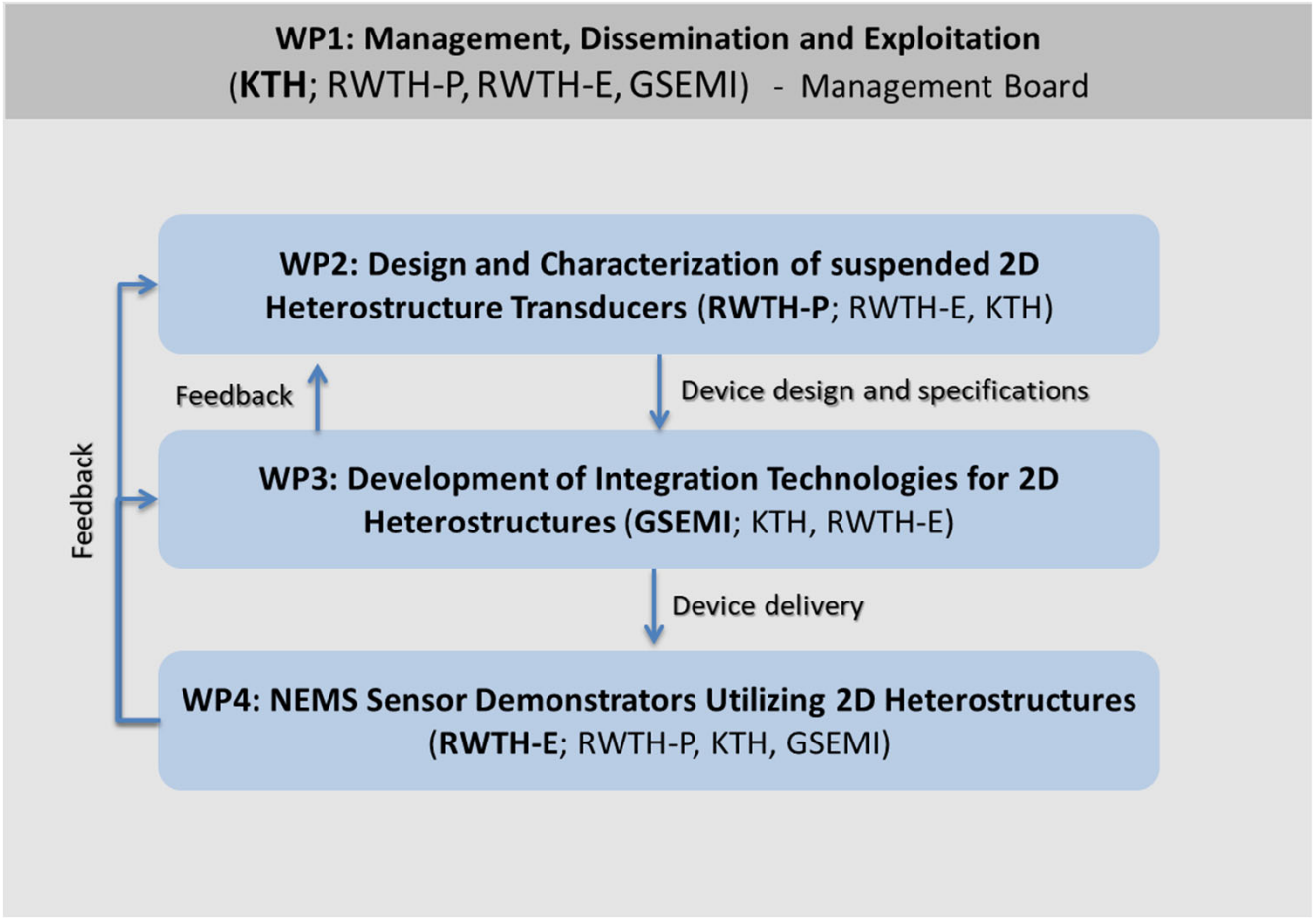


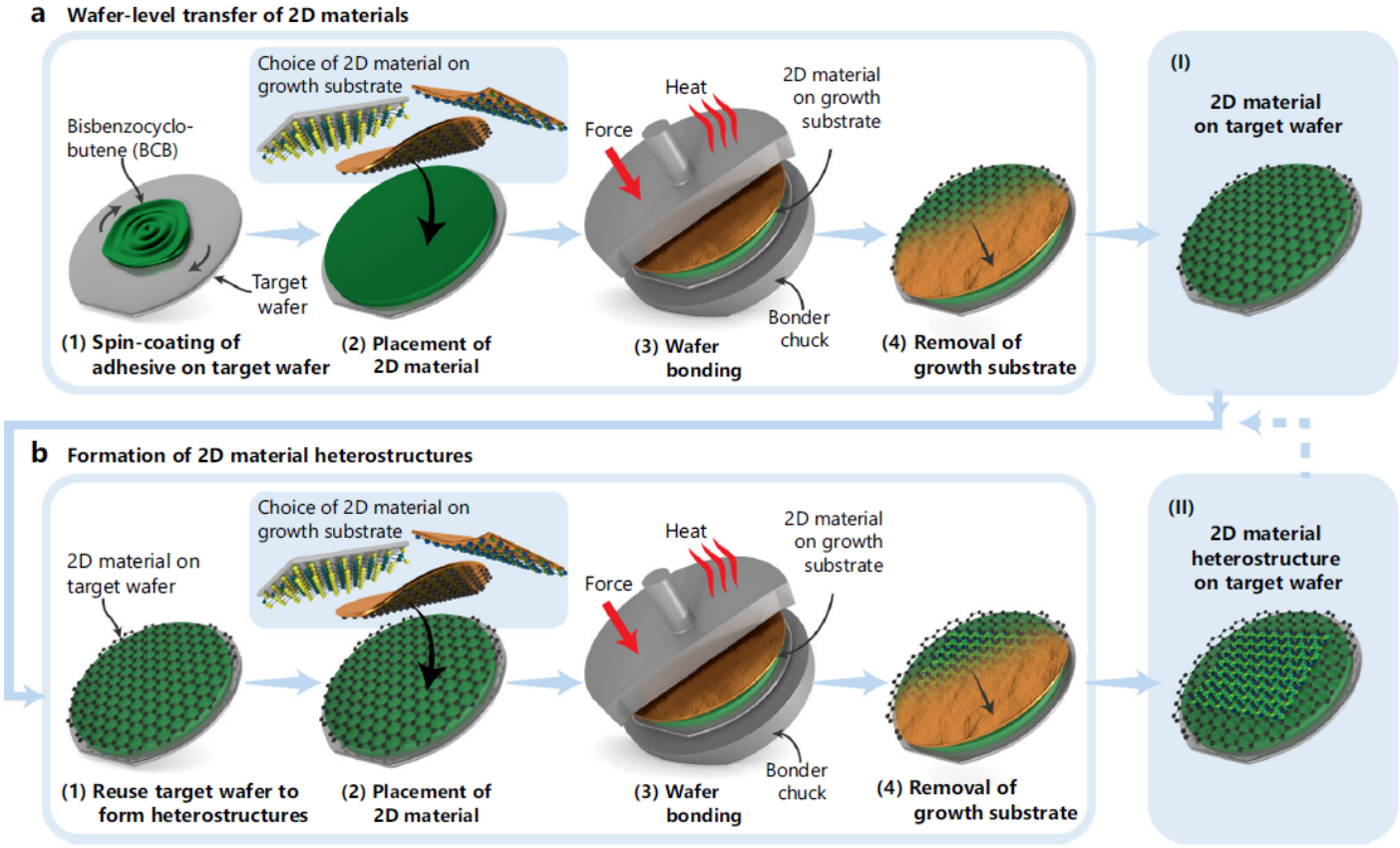
Project organization



Interaction with Graphene Flagship

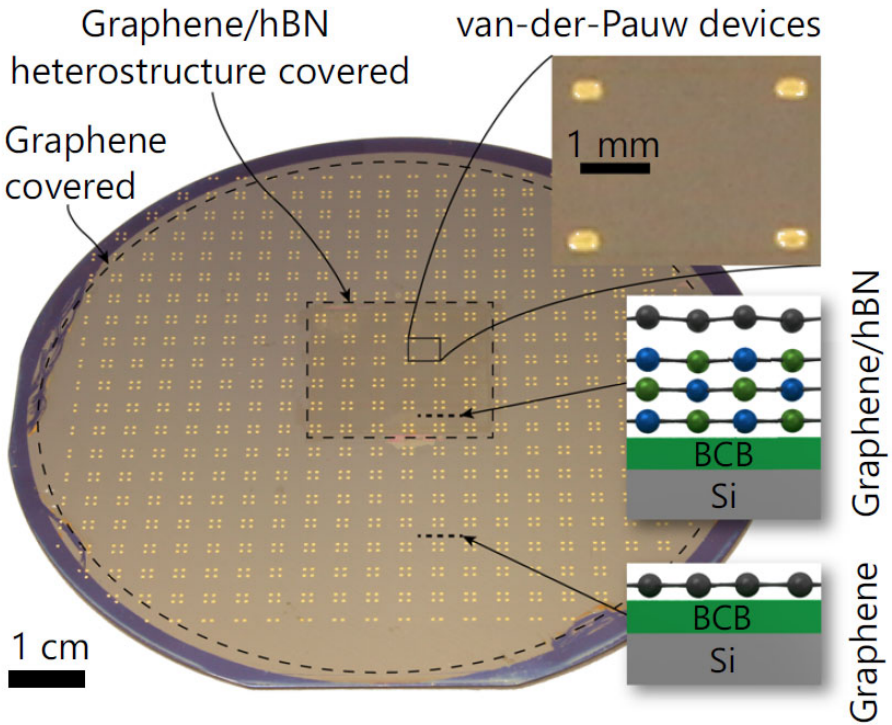
- RWTH and Graphenea are Flagship Core Partners,
  KTH is Associated Flagship Member.
- Synergies with multiple Flagship Work Packages:
  - Sensors, Enabling materials,
    Wafer-scale System Integration.
- 2D-NEMS members are involved in the new
  2D-Experimental Pilot Line project.
- 2D-NEMS members have parallel research collaborations with multiple core partners within Flagship: IMEC (Belgium), Uni. Bundeswehr München (Germany), ICN2 (Spain).
- 2D-NEMS results have been promoted by Flagship press team.

Large area production of 2D-material heterostructures

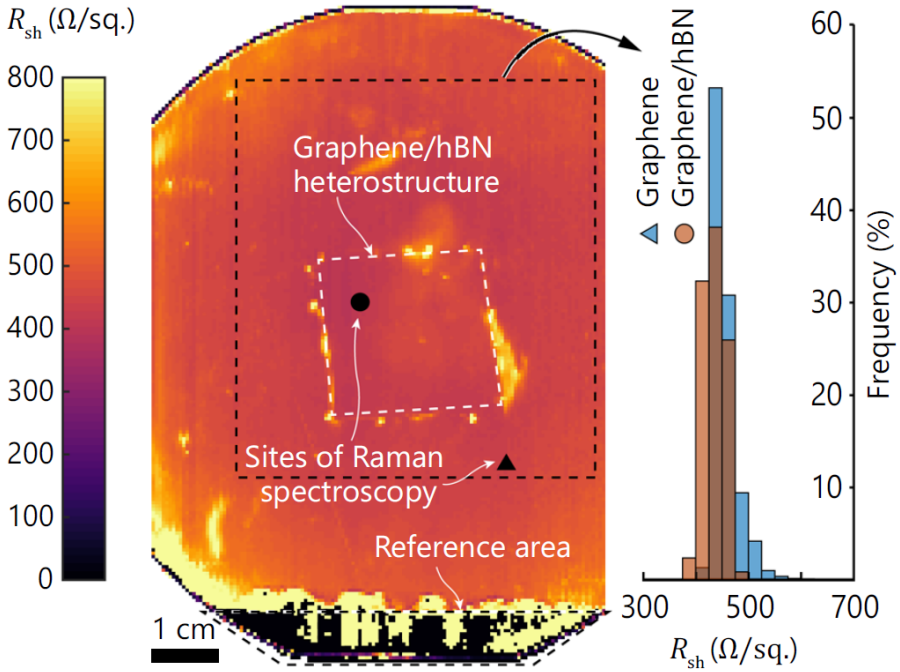


Large area production of 2D-material heterostructures

Graphene/hBN electronic devices

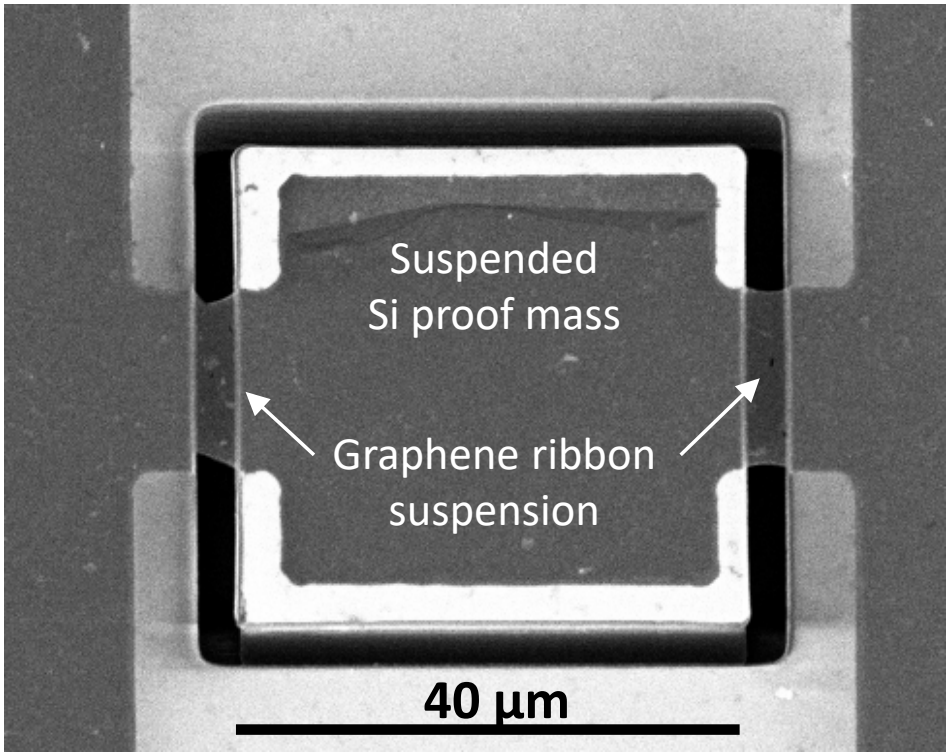


Wafer-scale heterostructure characterization

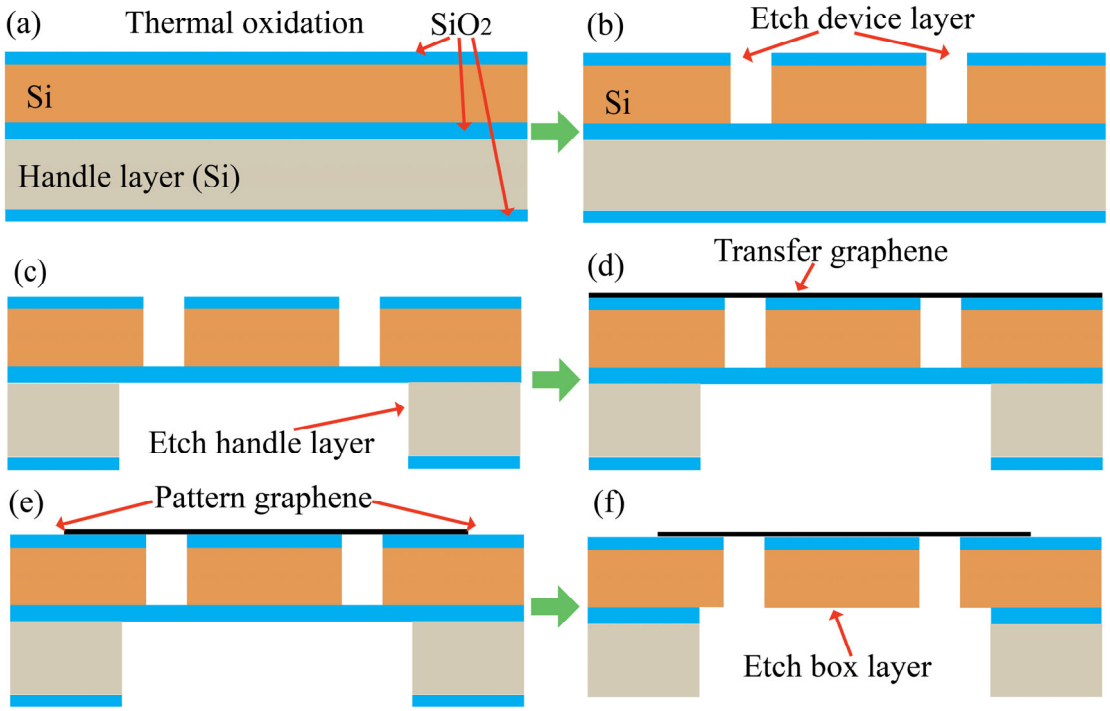


Graphene-based resonant accelerometers

Top view of accelerometer



Fabrication (cross-section)



Graphene-based resonant accelerometers