

## Graphene Nanostructures Integration in Nanophotonic Biosensors

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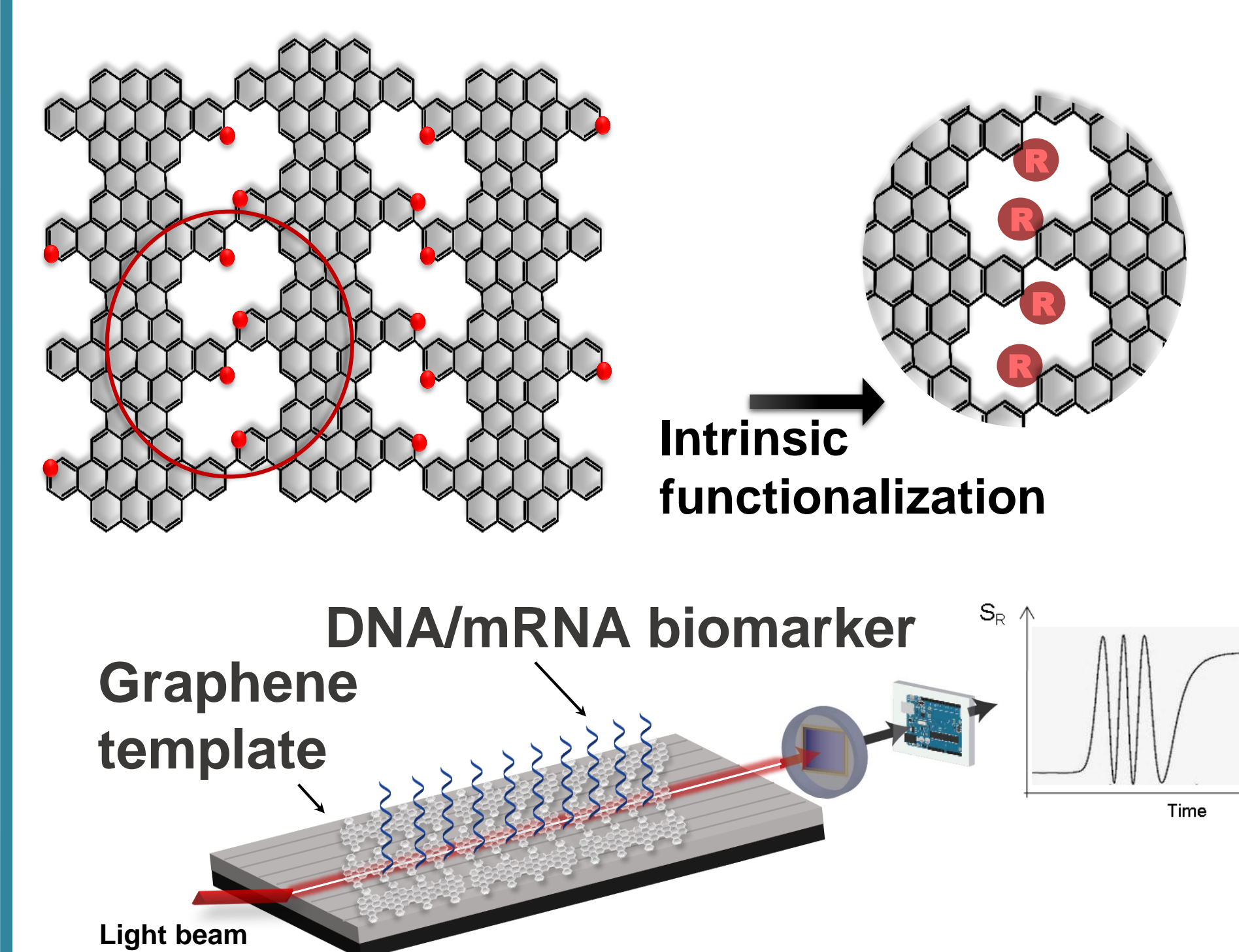
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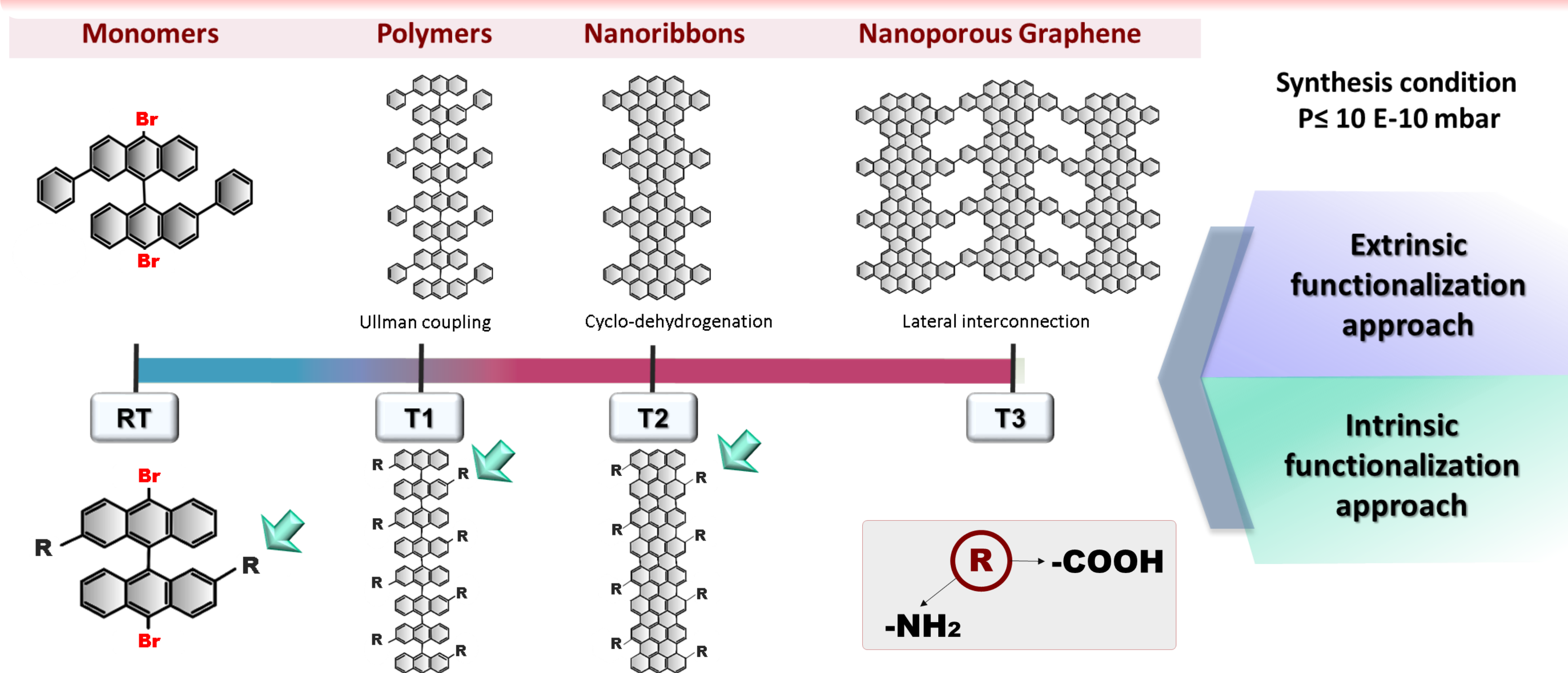


The Bimodal Waveguide (BiMW) interferometric biosensor has demonstrated outstanding sensitivities, multiplexing capabilities, and high potential for integration in compact and user-friendly devices [1]. One of the major challenges in the advance of biosensor technology is the reproducible biofunctionalization of the sensing area. The lack of precise control during the arrangement of the biorecognition interface severely limits the detection selectivity and reliability of actual devices, hampering the mass-production and implementation in the clinical field. By proposing an advanced method to produce functionalized graphene nanostructures with atomic precision, we aim to develop a universal sensor biofunctionalization protocol, which will facilitate a biorecognition molecular template control at the nanometer scale.

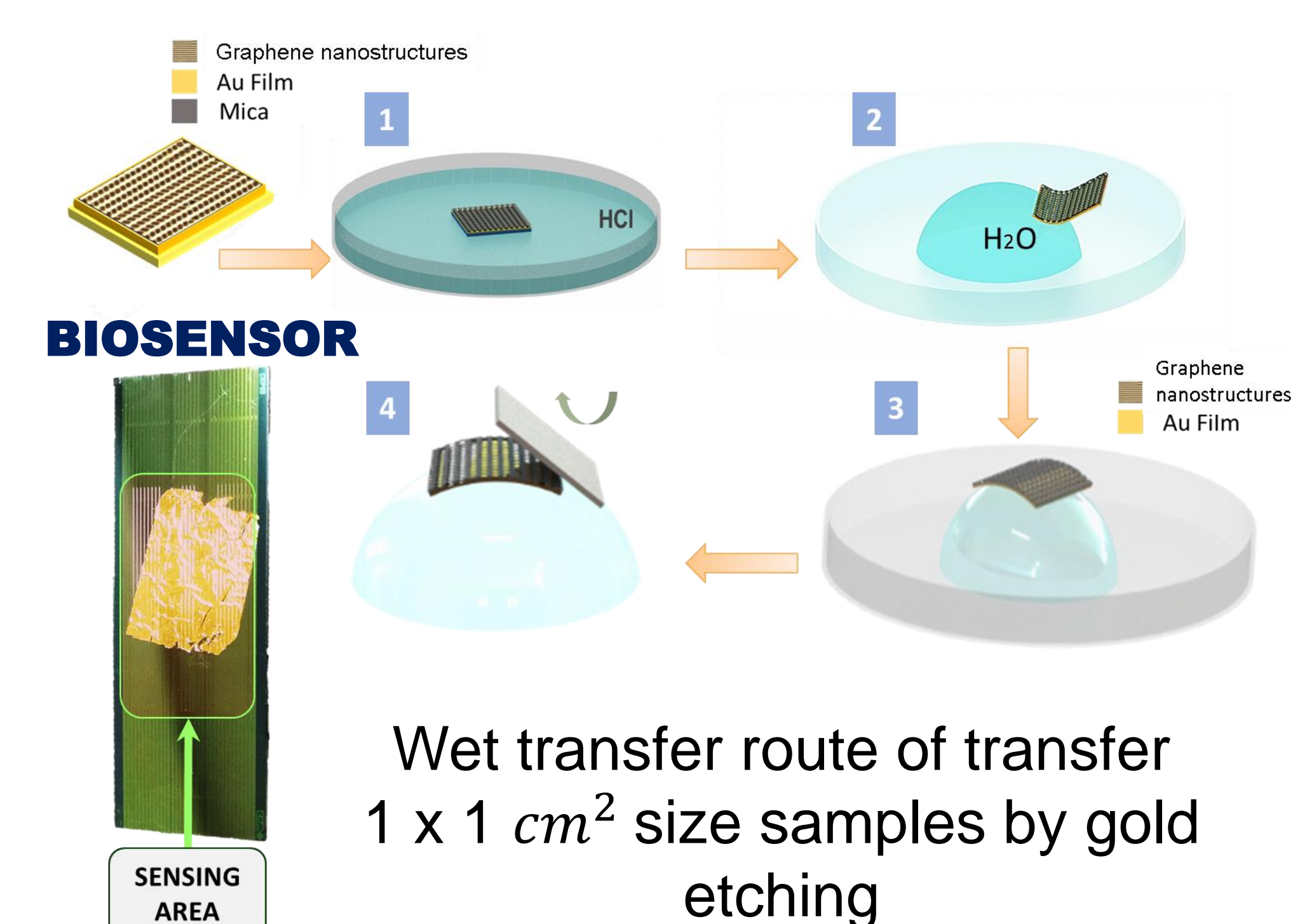
### Bimodal Waveguide (BiMW) Interferometer



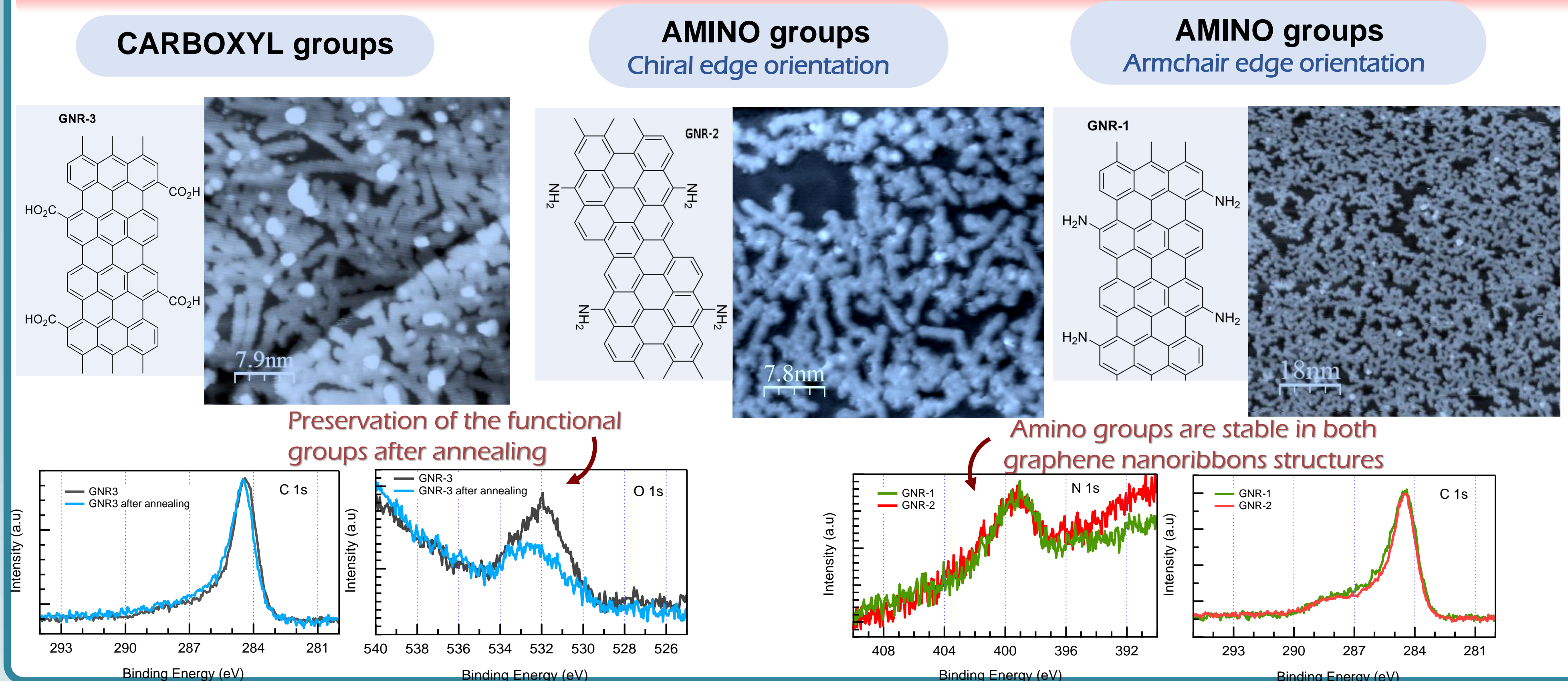
### Bottom-up strategy of 2D graphene nanostructures



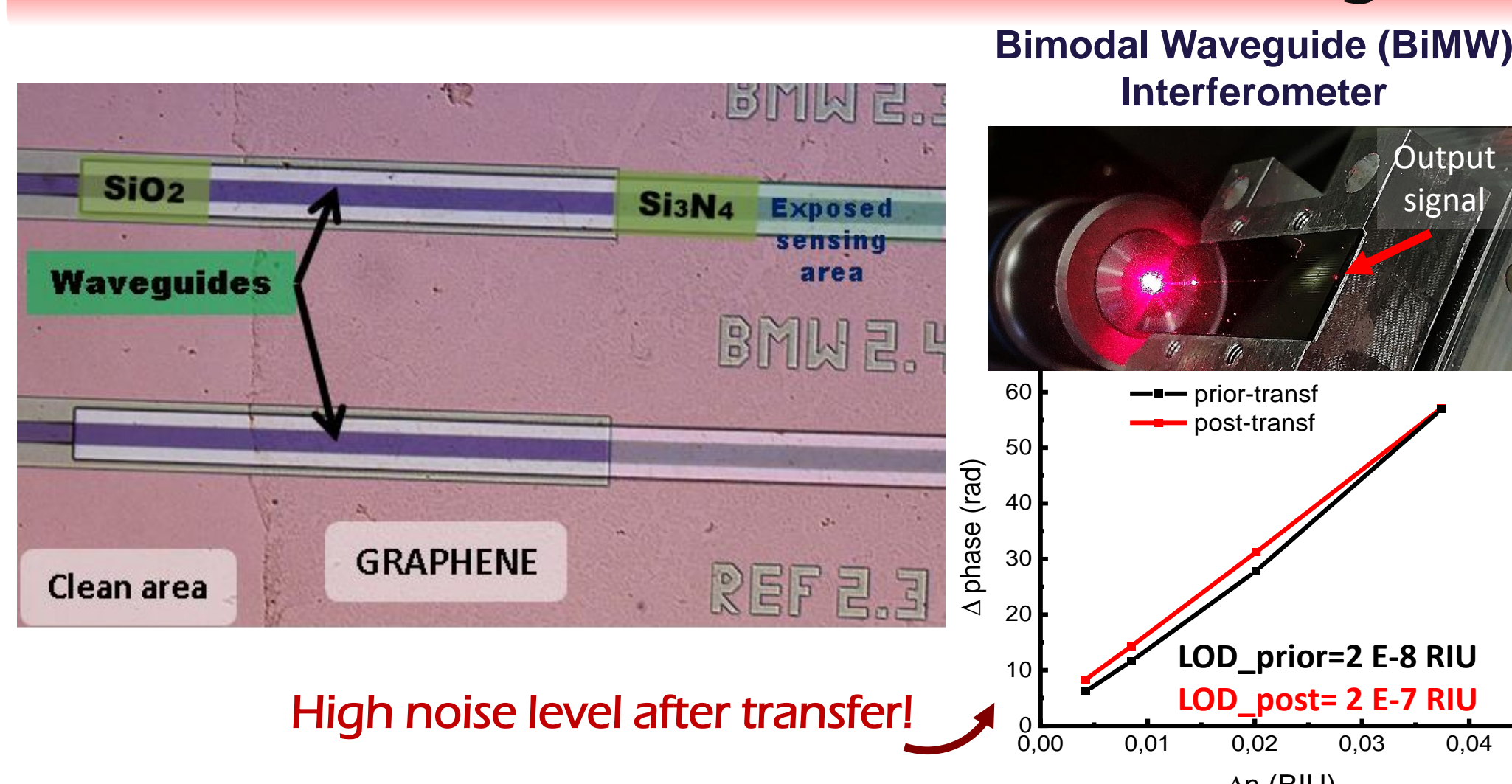
### Transfer onto Biosensor



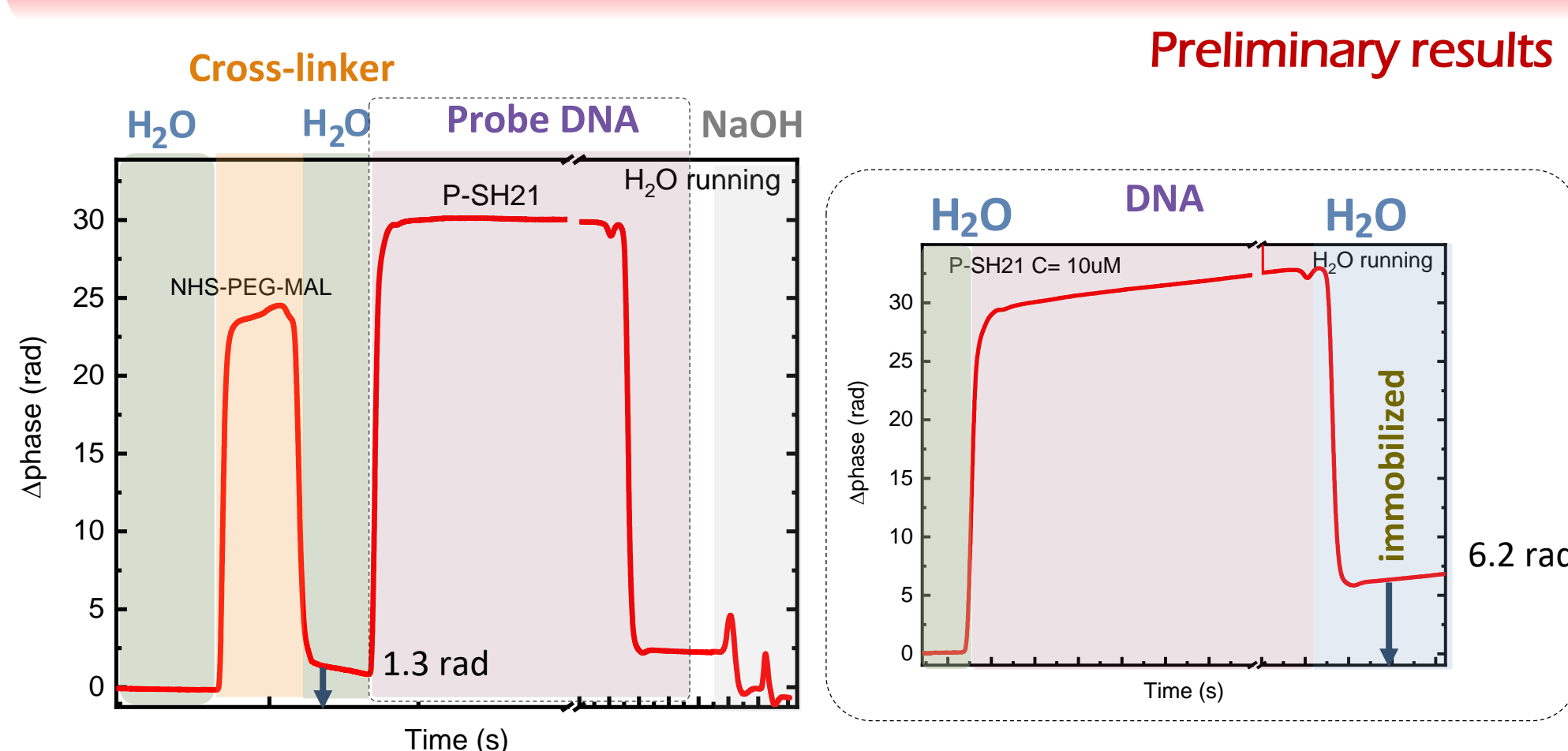
### Characterization of intrinsic functionalized ribbons



### Bulk refractive index change



### Graphene Biofunctionalization



### Conclusions:

- ❖ Intrinsically functionalized graphene nanoribbons grown in bottom-up approach
- ❖ Successfully transferred graphene nanostructures onto the biosensor
- ❖ Create a innovative and universal biofunctionalization protocol for early diagnosis and monitoring of melanoma cancer patients.



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### REFERENCES

- (1) M.C. Estevez et al., Laser & Photonics Reviews, 6(4), (2012) 463 – 487
- (2) C. Moreno et al., Science, 360, (2018) 199 – 203
- (3) Li et al., ACS Nano, 14 (2), (2020) 1895–1901

