

Assembly of Pillared Graphene Oxide Mesostructures

Francesca Cardano^{1,2}, Marco Frasconi³ and Silvia Giordani^{*1,4}

¹ Istituto Italiano di Tecnologia (IIT), Nano Carbon Materials, via Livorno 60, 10144 Turin, Italy.

² University of Genoa, Department of Chemistry and Industrial Chemistry, via Dodecaneso 31, 16146 Genoa, Italy.

³ University of Padua, Department of Chemical Sciences, via Marzolo 1, 35131 Padua, Italy.

⁴ Dublin City University, School of Chemical Sciences, Glasnevin, Dublin 9, Ireland.

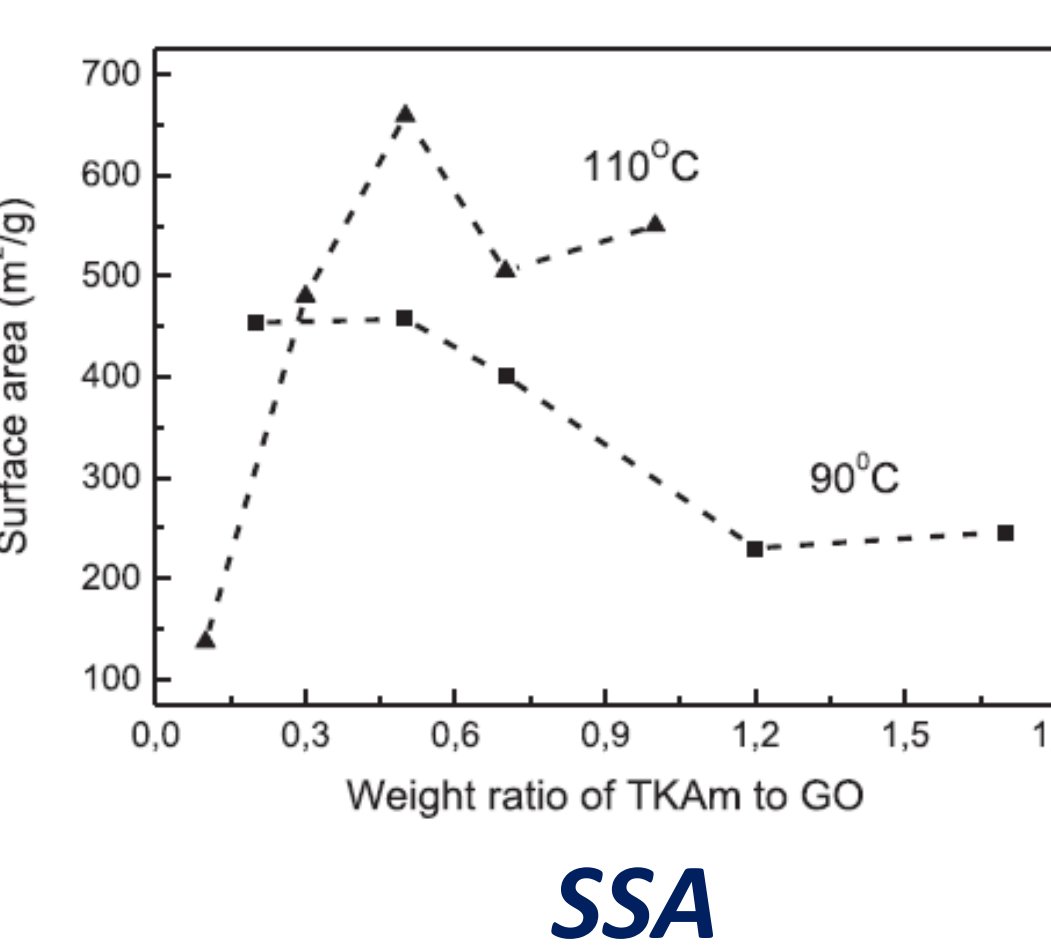
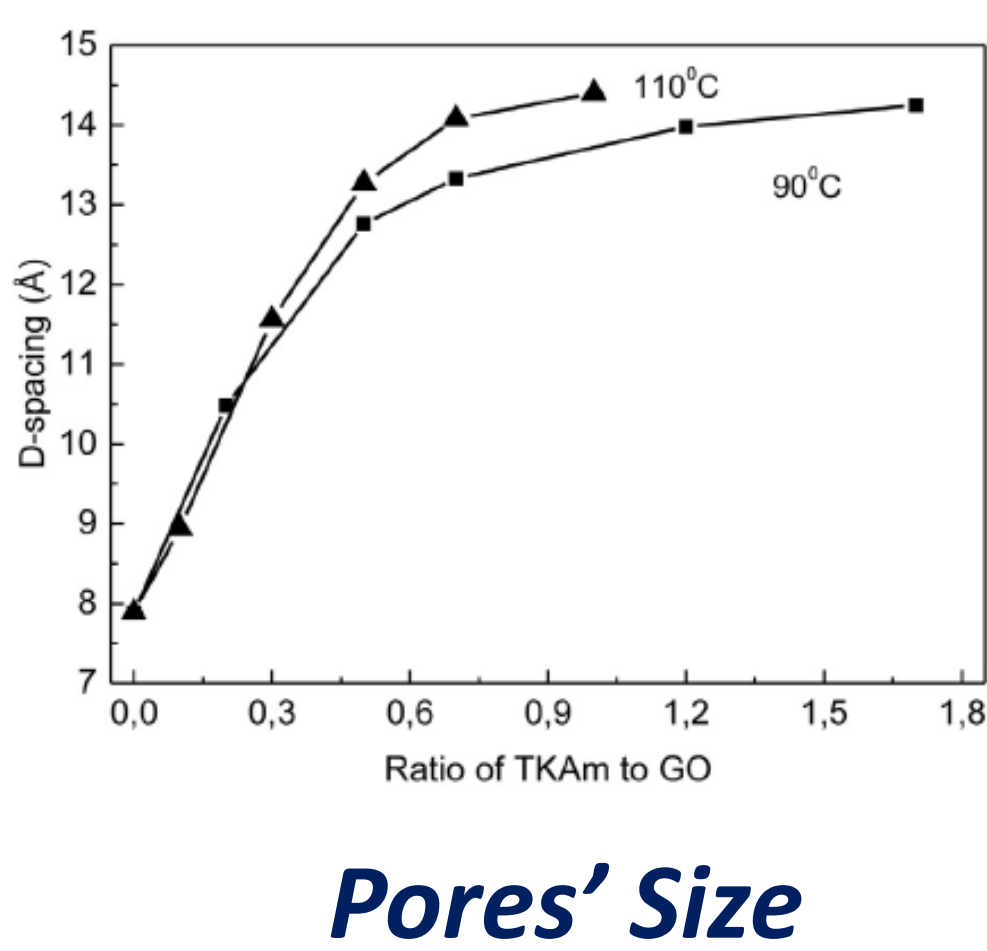
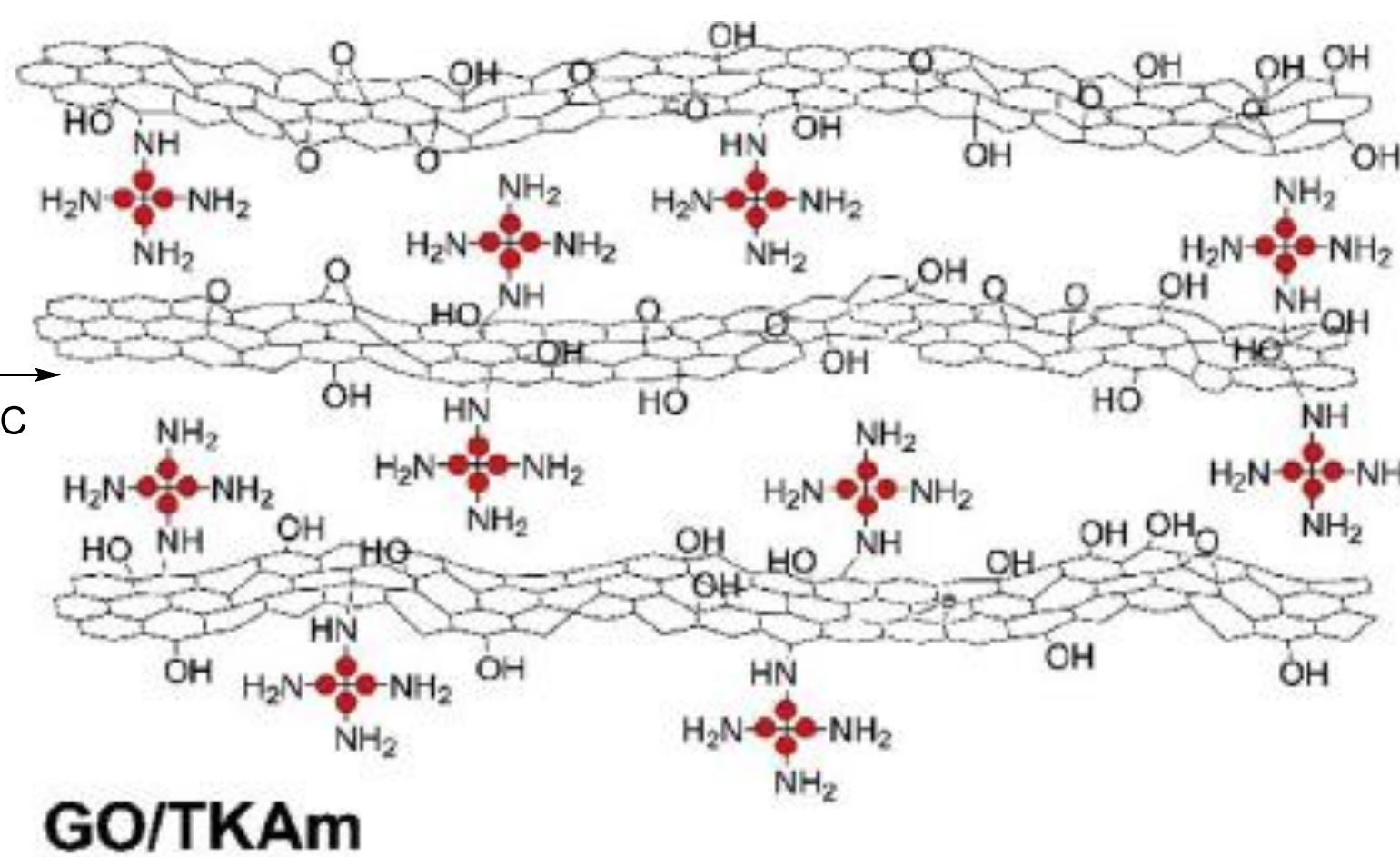
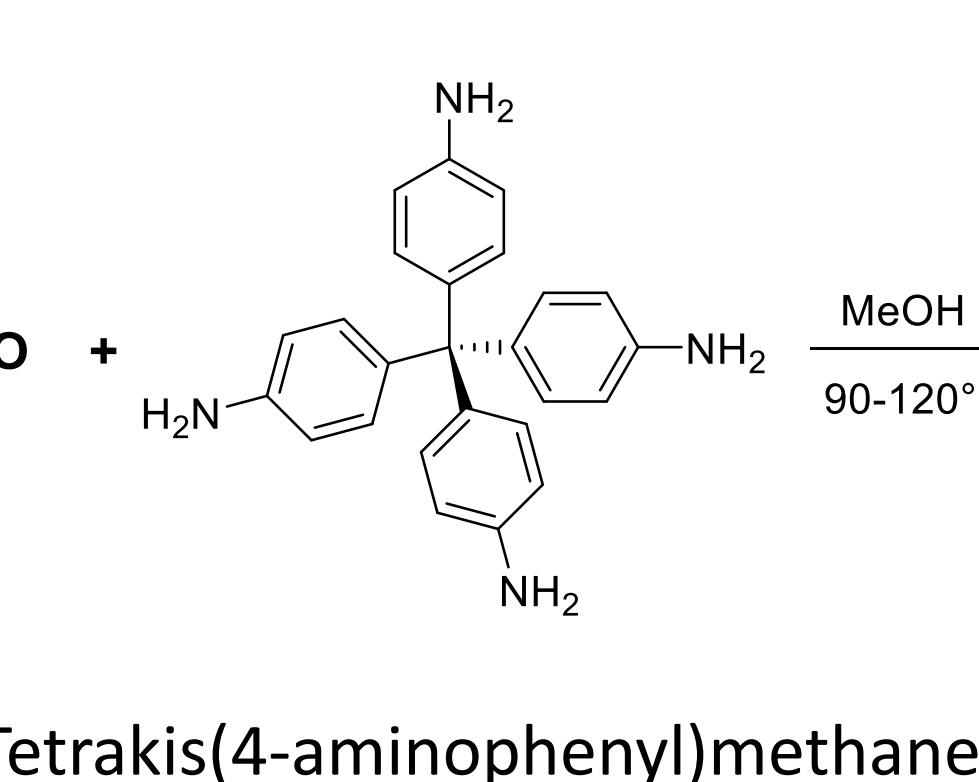
E-mail: francesca.cardano@iit.it

OVERVIEW

During the past years brilliant results have been obtained by the assembly of Hybrid Multilayers' Graphene Oxide based mesostructures.^{1,2} The chemical functionalization of GO with molecular pillars, presenting intrinsic properties and defined shape and size, represent the ideal tool for the achievement of these goals.^{3,4} Here we show 3 different molecular spacers for the development of GO based structures with particular properties:

1. **Tetrapod**-like amino spacers to create rigid 3D assembly
2. **Aldehyde** spacers to generate flexible linkers between the layers
3. **Azobenzene** spacers to have photo-controllable materials.

GO and TKAm *

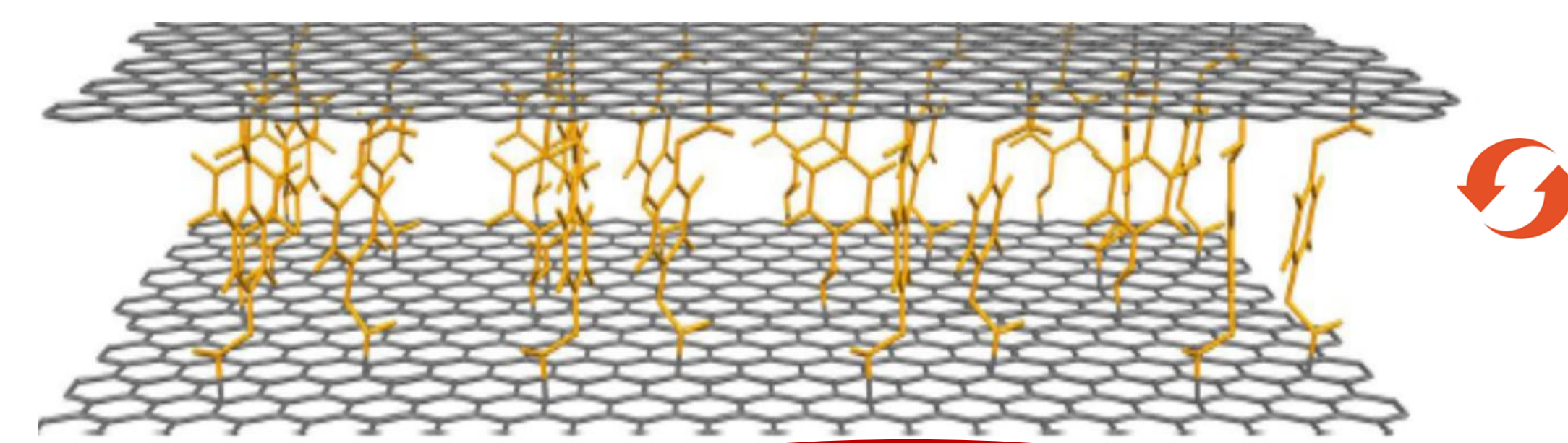
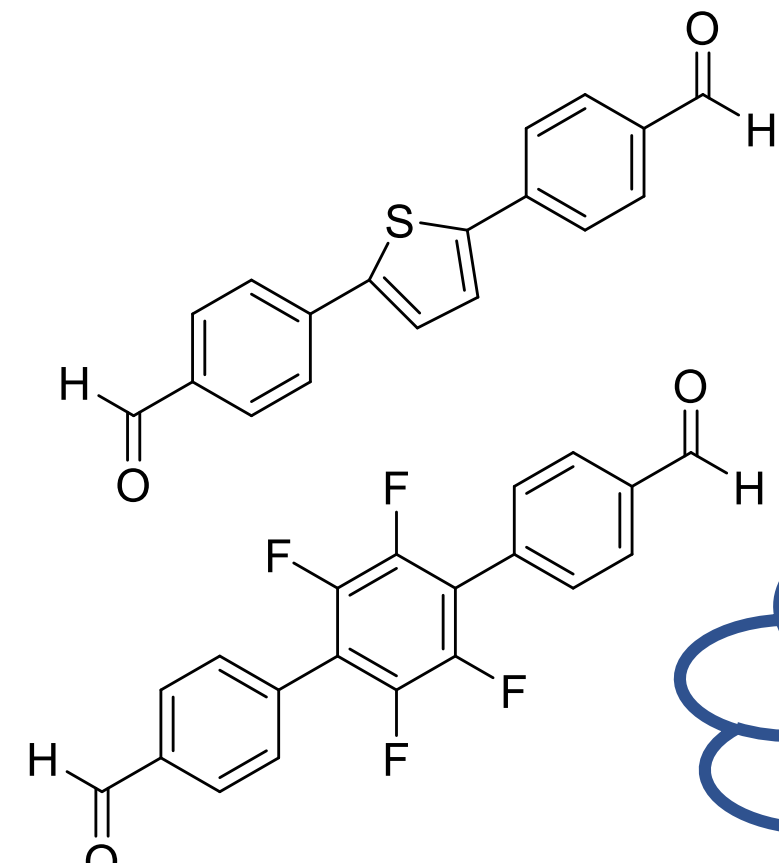
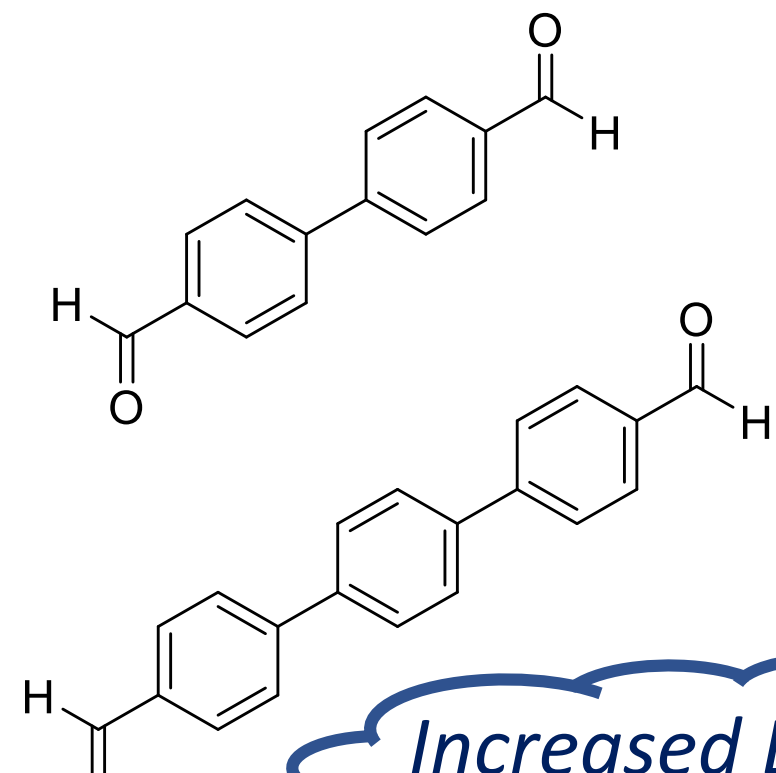
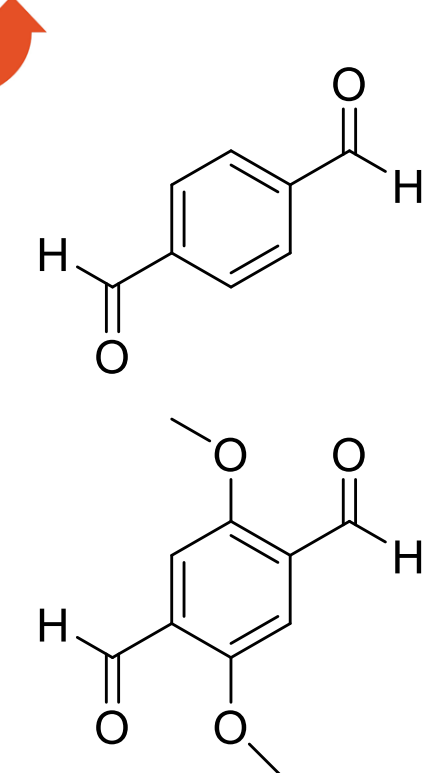


ACHIEVED RESULTS

- Interlayer distance up to ~ 14 Å
- SSA up to ~ 660 m²/g
- Good Hydrogen Sorption capabilities

ONGOING PROJECTS

Flexible assemblies Aldehyde linkers_

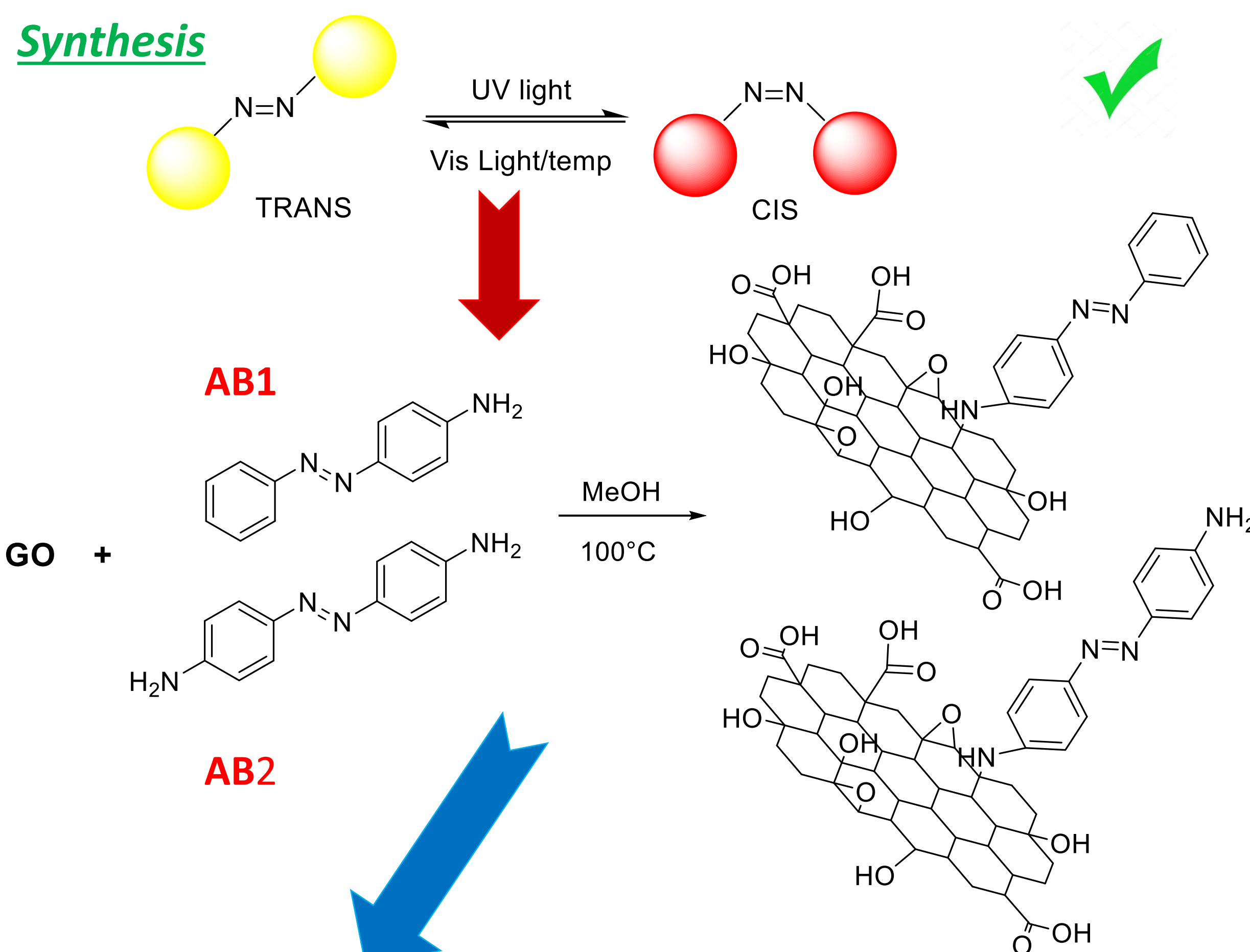


Increased Length & Study the effect of Heteroatoms

GOAL: link the molecules to the material through imine bonds to have mobility in the final assembly

Photoresponsive assemblies Azobenzenes_

Synthesis



AB molecules

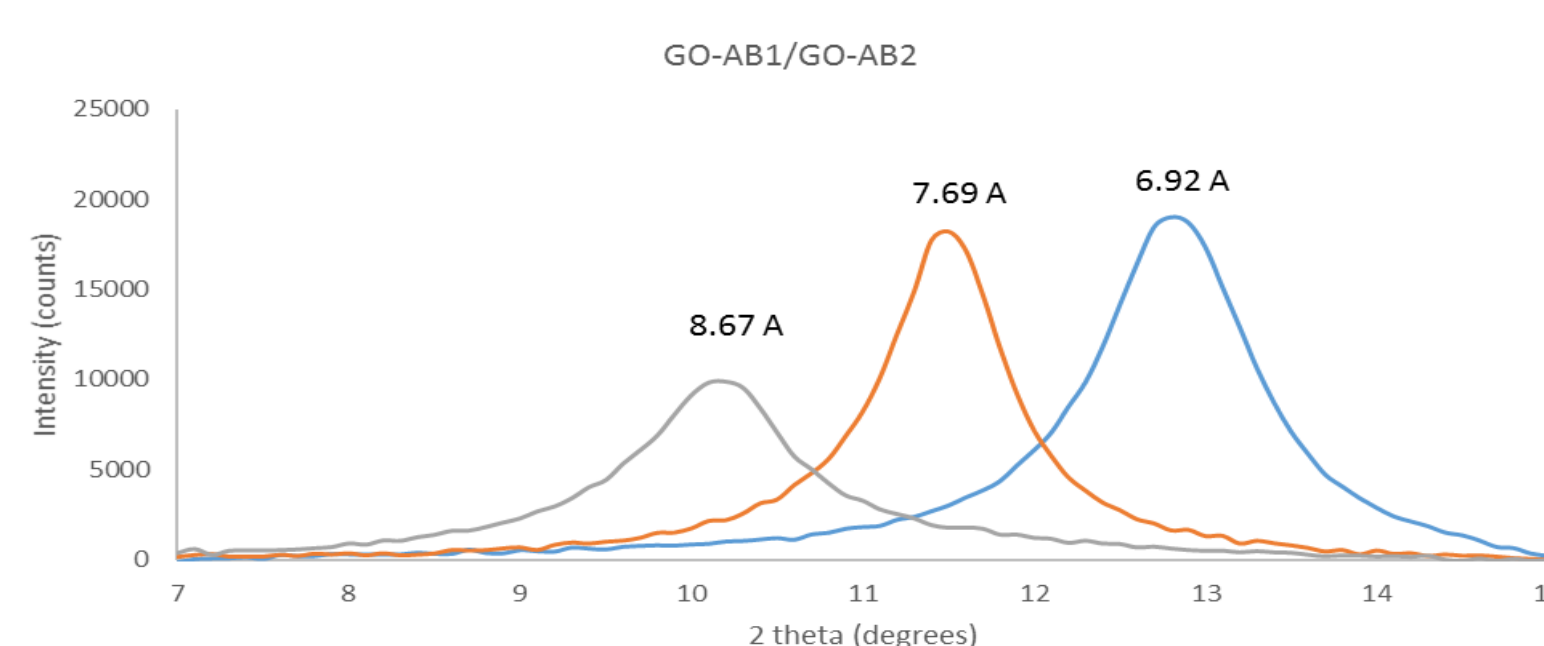
Hybrid material

Photoresponsive material

GOAL

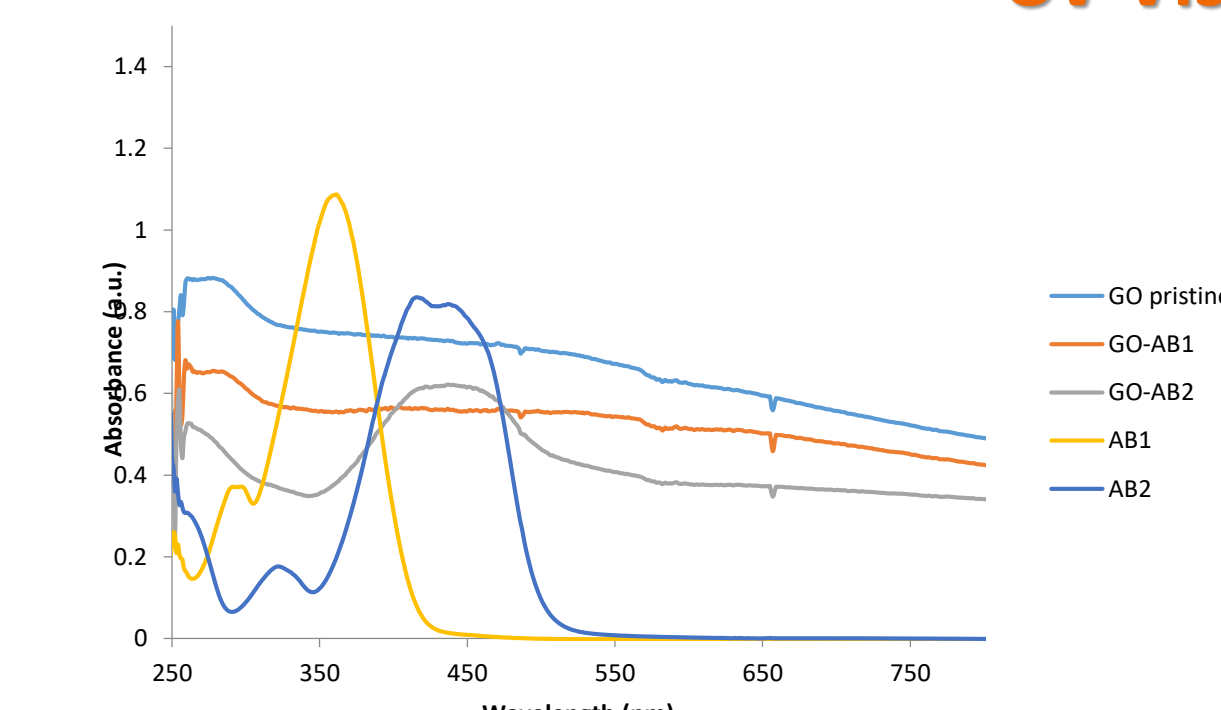
- Synthesis of AB differing each other in the number of amino functionality (1 or 2)
- Study of the Hybrid Material defining properties and difference due to the different functionalities
- Characterization of the material under Uv light
- Bio-applications

XRD

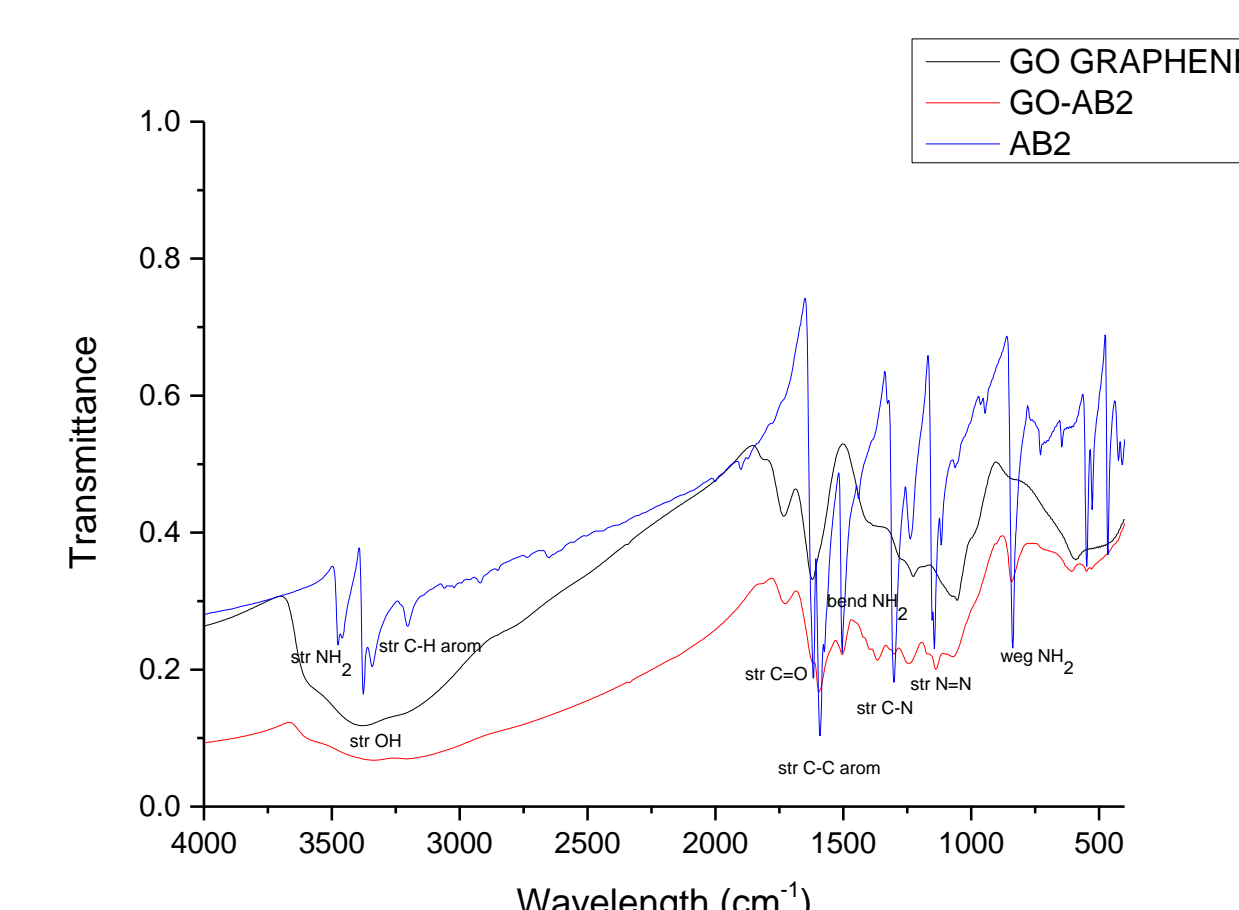
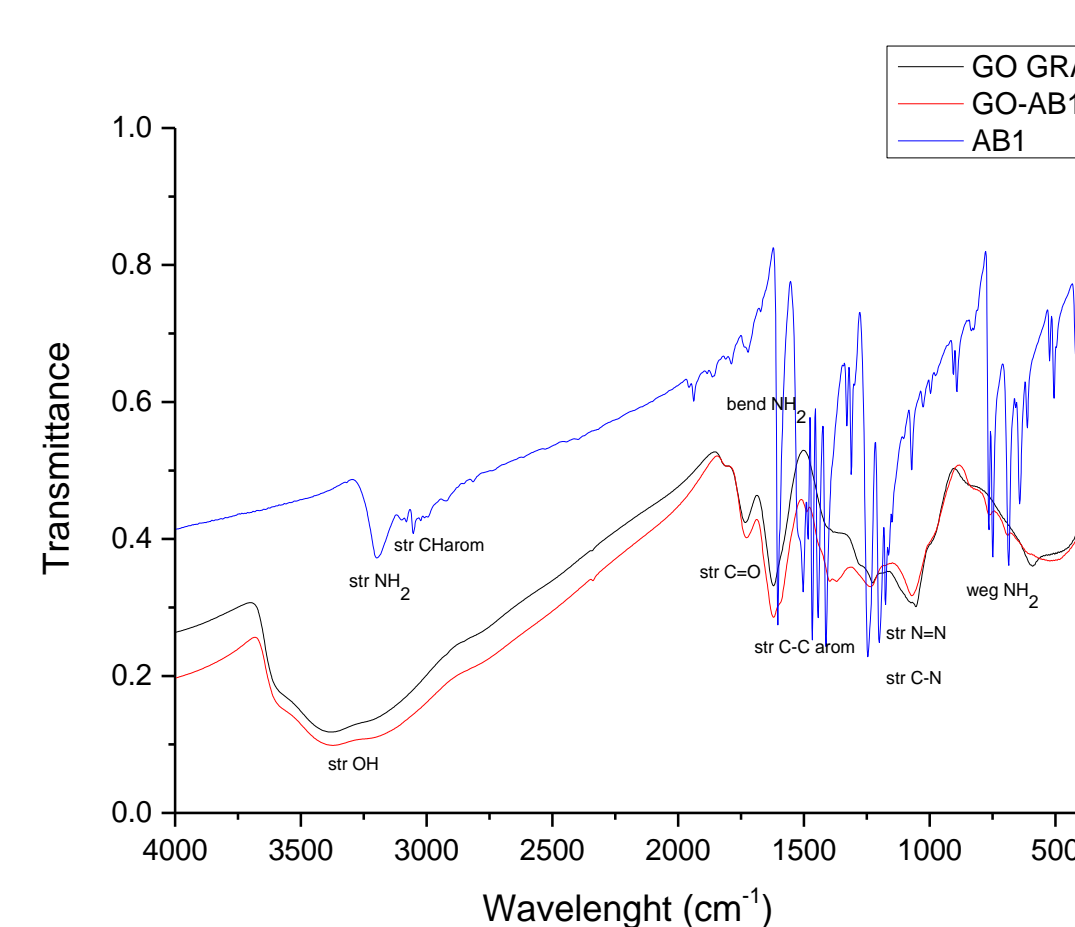


Characterization of the Material

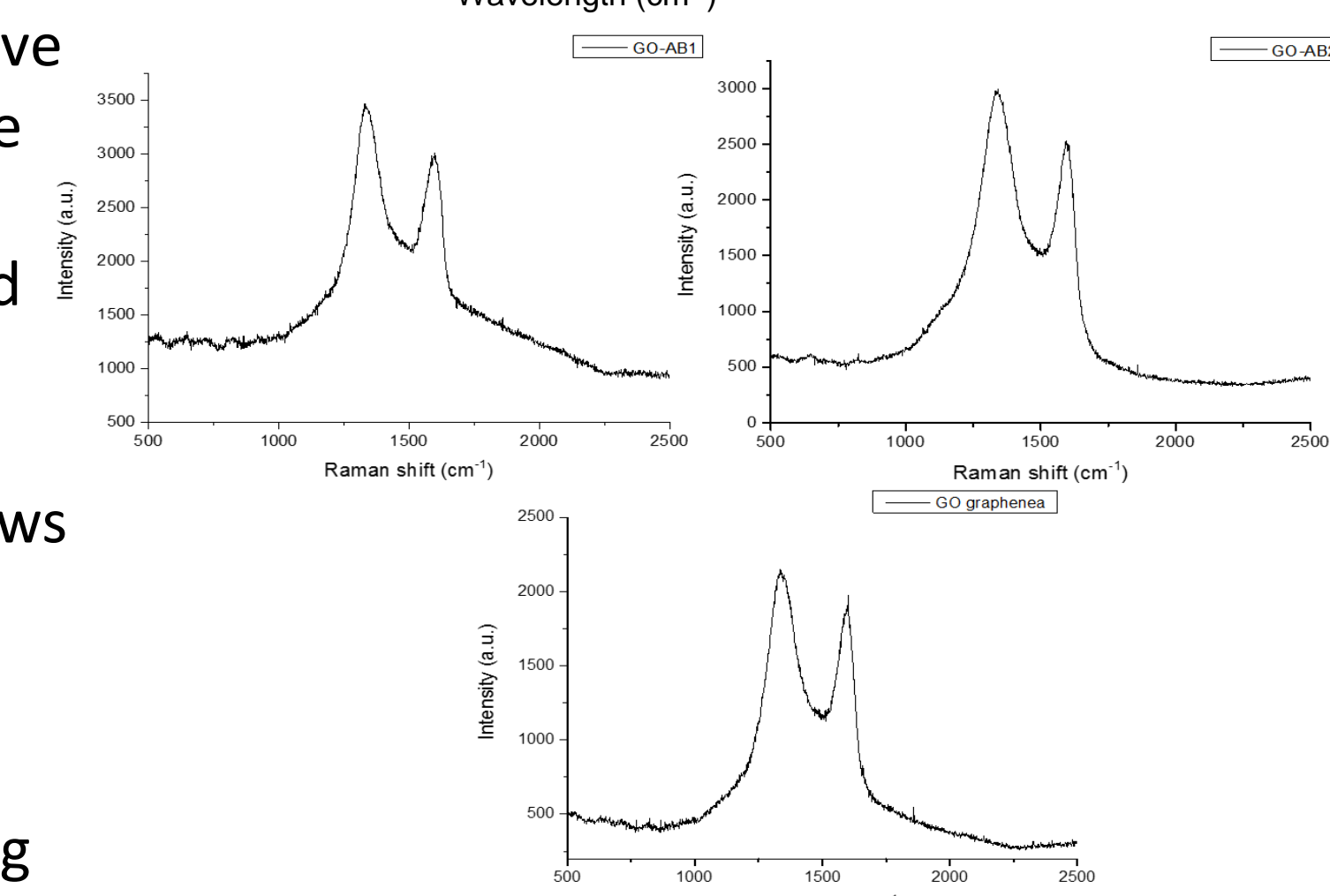
Uv-Vis



FTIR



RAMAN



XPS measurements have confirmed the presence of C/O/N elements. The material assembled with AB2 shows 4% of N while the one prepared with AB1 shows 1% of N.

Cyclic Voltammetry measurements: ongoing

CONCLUSIONS

These materials show precise distance of the GO layers, specific pores' size, high surface area, and the eventual possibility to control their properties with external stimuli. These peculiarities pave the way for applications in several research fields: from energy storage purposes and membrane preparation to applications in the biological realm.

REFERENCES

- [1] Gadipelli, Z.X. Guo, *Progress in Materials Science*, 2015, 69, 1.
- [2] G. Mercier, A. Klechikov, M. Hedenström, D. Johnels, I. A. Baburin, G. Seifert, R. Mysyk, A. Talyzin, *J. of Physical Chemistry C*, 2015, 119, 27179.
- [3] J. Sun, F. Morales-Lara, A. Klechikov, A. Talyzin, I.A. Baburin, G. Seifert, F. Cardano, M. Baldrighi, M. Frasconi, S. Giordani, *Carbon*, 2017, 120, 145.
- [4] F. Cardano, M. Frasconi, S. Giordani, *Frontiers in Chemistry*, 2018, 6, 102.

ACKNOWLEDGEMENTS

Istituto Italiano di Tecnologia (IIT) is acknowledged for financial support.