

Annual presentation for the first year of PhD Nanoscience.



SCUOLA
NORMALE
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PISA



Presented by- Ayush Tyagi

Supervisor- Dr. Camilla Coletti

National Enterprise for nanoScience and nanoTechnology



Attended courses during first year of PhD.

RELAZIONE ATTIVITA' ANNUALE DEI PERFEZIONANDI/DOTTORANDI – PRIMO ANNO REPORT ON THE PHD ACTIVITY – FIRST YEAR

NOME E COGNOME NAME AND SURNAME	AYUSH TYAGI
DISCIPLINA/PHD COURSE	NANOSCIENCE

CORSI FREQUENTATI CON SOSTENIMENTO DI ESAME FINALE ATTENDED COURSES (WITH FINAL EXAM)	VOTAZIONE RIPORTATA MARK	NUMERO DI ORE HOURS
Introductory Quantum Physics	28/30	40
Nanostructured Materials	26/30	40
Condensed Matter Physics	28/30	50

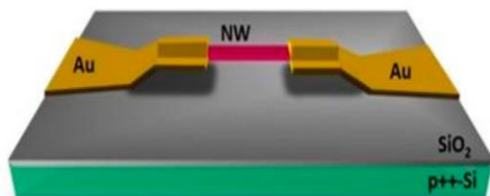
CORSI FREQUENTATI SENZA SOSTENIMENTO DI ESAME FINALE ATTENDED COURSES (ATTENDANCE ONLY)	NUMERO DI ORE HOURS
Italian Language (Intensive Course)	10
Training course on health and safety	8

Information About Stages.

A. Semiconductor based nanowires.

(with F. Rosella and Domenic Prete)

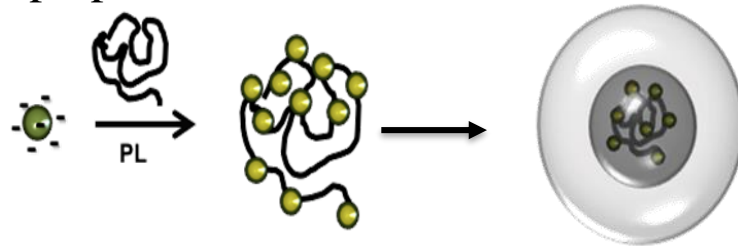
- Device fabrication and characterization of III-V (InAs) based suspended nanowires.
- Quantum transport measurements at nanoscale.
- Thermal conductivity measurement using 3ω -method.



B. Manipulation of colloidal nanostructures for clinical and industrial application .

(with Valerio Voliani, D. Cassano and G. Giannone)

- Learned basic production procedure for noble metal nanomaterials in liquid solution.
- AuSi based standard nanoparticles preparation.

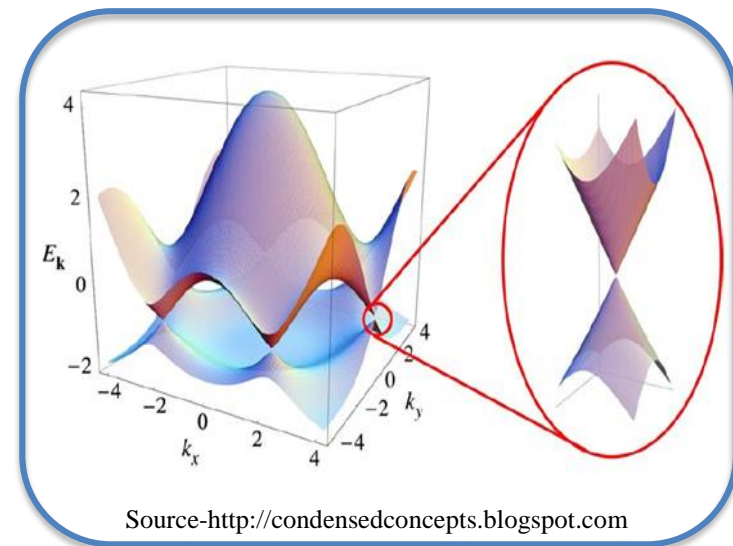
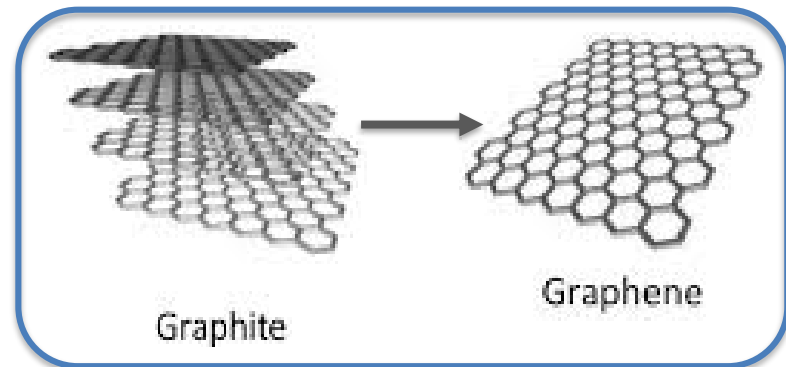


PhD Thesis Topic

“Tailoring electrical properties of Graphene using organic polymers.”

Graphene

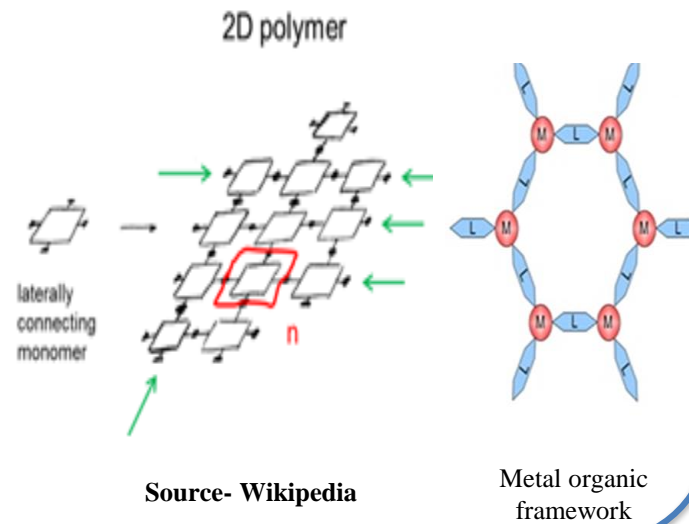
- 2D layered allotrope of carbon.
- High electron mobility ($\sim 50000 \text{cm}^2/\text{Vs}$), high Young's modulus (1TPa) and much higher thermal conductivity ($> 5000 \text{Wm}^{-1}\text{K}^{-1}$) as compare to other carbon structures.



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Why organic polymer?

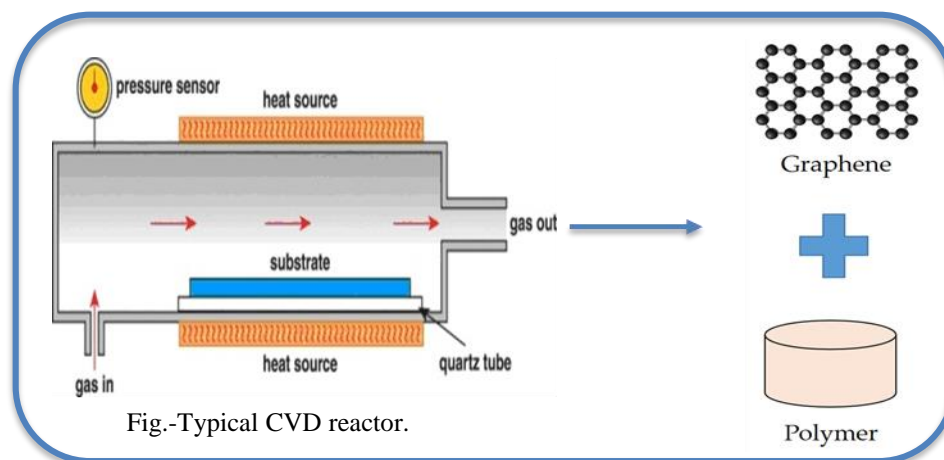
- 2D polymers can be considered in metal organic framework, e.g., Cu-BHT($[\text{Cu}_3(\text{C}_6\text{S}_6)]_n$) which are conducting.
- The objective will be to see the modification in electrical properties of Graphene by depositing these 2D organic polymers on top.



Experimental Procedure

(A)

- Synthesis of graphene using CVD
- Polymer deposition using spin coating.



(B)

- Chemical, structural and electrical characterizations will be done by using RAMAN, AFM, STM, Four probe measurement etc. while for device fabrication EBL will be used.



RAMAN

Trainings attended during the first year-

- RAMAN, STM and AFM.
- Clean room general training which includes use of spinner, O₂ plasma etching, optical microscope and wet bench.



STM

References

- A two-dimensional pi-d conjugated coordination polymer with extremely high electrical conductivity and ambipolar transport behavior Xing Huang¹, Peng Sheng¹, Zeyi Tu¹, Fengjiao Zhang¹, Junhua Wang, doi: 10.1038/ncomms8408.
- Challenge of rubber/graphene composites aiming at real application, Zhijun Yang, Baochun Guo, Liqun Zhang, rubber chemistry and technology, Vol. 90, No. 2, pp. 225–237 (2017).
- <http://condensedconcepts.blogspot.com>



*THANK
YOU!*

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