IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 14, Issue 5, Ser. I (Sep.-Oct. 2019), PP 10-11
www.iosrjournals.org

Photospintronics- Light-Controlled Spin Transport in Hybrid Chiral Oligopeptide-Quantum Dot Structures

Rupshali Roy
3rd year, Electronics and Telecommunication Engineering, IIEST Shibpur

Abstract*—*It has been found that the transmission of electrons through chiral molecules depends on their spin orientation; this effect is known as chiral induced spin selectivity (CISS).In this summer project, we began the building of a device which would help in furthering studies and research on spintronics.

Keywords:*Spintronics, Spin Filtering, Quantum Dots*

Date of Submission:15-10-2019 Date of Acceptance:31-10-2019

I. Photospintronics- Light-Controlled Spin Transport In Hybrid Chiral Oligopeptide-Nanoparticle Structures

The control of spin transportation by light combines 2 technologies, photonics and spintronics. Having organic material makes the juxtaposition of the 2 technologies simpler, because the light-absorbing properties of organic molecules can be modified relatively easily. In the recent past, it has been discoveredthatthe transmission of electrons through chiral molecules depends on their spin orientation; this effect is known as chiral induced spin selectivity (CISS).This effect makes it feasible to build spintronic devices without ferromagnetic spin injectors because the chiral molecules themselves serve to choose a specific spin to transfer across the molecules.

In this summer project, we began the building of a device which would help in furthering studies and research on spintronics. It consists of an Si substrate, plated with a layer of Ni, a ferromagnetic material, further coated by a layer of gold, as the base layer. In the hybrid system studied therein. Helical chiral molecules of cysteine hydrochloride were attached on one end to the base layer mentioned above, and on the other end to a MoS_2 thin film.

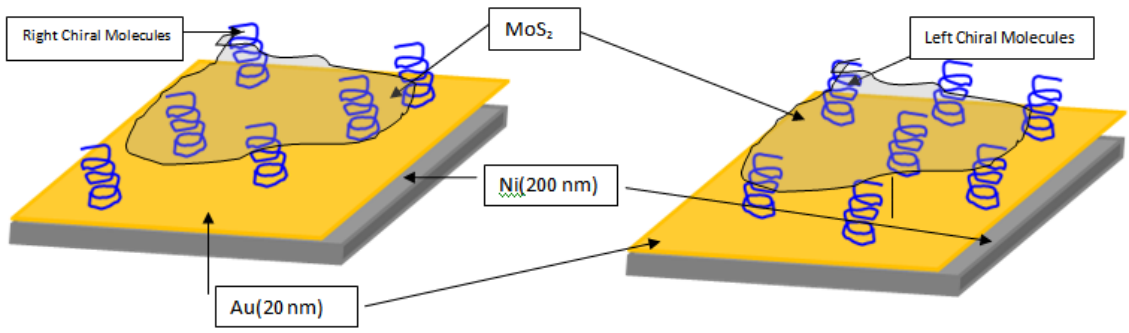

Figure 1: Schematic representation of the experiment

A flake of ultrapure MoS_2 was taken in isopropanol and subjected to ultrasonic vibrations. The flake broke into tiny particles suspended throughout the liquid.Then 10 mg of cysteine hydrochloride was dissolved in 10 ml ethyl alcohol. Using a spin coater, 1 ml of the cysteine hydrochloride solution was spread all over the surface of the base layer, followed by the MoS_2 layer.

The chiral molecules taken in this case were right helical structures. When right circularly polarized light is shined on the device thus built, electron hole pairs are generated and those electrons with right handed spin are excited and are selected to move through the chiralmolecules. When left circularly polarized light is incident, it is expected that electrons with left handed spin will be excited and will be selected for transport through the molecules to the substrate. It is expected that the results would be vice versa for chiral molecules with left handed helicity. During my period of work, the device has been constructed and preliminary work has begun on the study of emission spectra to locate the points on the MoS_2 film which are acting as quantum dots

and allowing the electrons to be spin filtered, using Raman spectroscopy and photoluminescence measurements. This project is continuing, and we expect to get interesting findings in a few months.

ABBREVIATIONS:
mg= milligrams
ml=millilitres

II. Declarations

AVAILABILITY OF DATA AND MATERIALS:
Not applicable

FUNDING:
Not applicable

AUTHORS' CONTRIBUTION:
Not applicable

COMPETING INTERESTS:
The author does not have any competing interests.

Acknowledgements

I would like to thank Prof AchintyaSingha for giving me an opportunity to do this summer internship under his guidance, and MrSuvadipMasanta for helping me to carry out the experimental observations and taking this project forward. The materials and equipment used were provided by Bose Institute, Kolkata and Department of Chemistry, Rajabazar Science College, Calcutta University and I am grateful for their help and support.

IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) is UGC approved Journal with Sl. No. 5016, Journal no. 49082.

Rupshali Roy. "Photospintronics- Light-Controlled Spin Transport In Hybrid Chiral Oligopeptide-Quantum Dot Structures." IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) 14.5 (2019): 10-11.