

Visit Report

Prof. Gunther Andersson, an endowment chair at Manipal University Jaipur

1. Name, Designation with department	<p>Prof. Gunther Andersson Professor of Chemical Physics and Nanotechnology Research Leader Flinders Centre for NanoScale Science and Technology College of Science and Engineering Flinders University, GPO Box 2100, Adelaide SA 5001, Australia Email: gunther.andersson@flinders.edu.au www.flinders.edu.au</p>
2. Host Faculty and Department(s)	<p>Prof. G. C. Tikkiwal Prof. A. K. Sinha Dr. Pushpendra Kumar Dr. Sushil Kumar Jain School of Basic Sciences, Department of Physics Manipal University Jaipur, Jaipur-303007, Rajasthan, India Email: pushpendra.kumar@jaipur.manipal.edu</p>
3. Date of visit	<p>August 12 – 22, 2017</p>
4. Invited Talk Date: August 13, 2017	<p style="text-align: center;">Title: Metal Clusters on Semiconductor Surfaces</p> <p>Short Abstract: Metal clusters have unique properties that change with the type and number of atoms that form the cluster. Metal clusters typically consist of less than about 100 atoms, are atomically precise and thus have specific size and shape. As a consequence of this, clusters also have discrete, individual electron energy levels, which i) differ from the levels in the constituting individual atoms and ii) depend on the number of atoms in the cluster. Due to their unique, size-dependent electronic properties, some metal clusters have been termed “superatoms” and can be considered as the 3rd dimension of the Periodic Table. Conceptually, the ability to control the size and energy levels of a metal cluster is ideal for modifying semiconductor surfaces, however, to date this is a rather challenging subject. Depositing metal clusters onto semiconductor surfaces allows to modify the electronic properties and chemical composition of the semiconductor surface precisely and independently from the properties of the bulk material. In the present work we are using mainly ligand protected, chemically made metal clusters.</p> <p>For analysing all stages of the process of depositing clusters onto semiconductor surfaces electron spectroscopy techniques (X-ray photoelectron spectroscopy (XPS)), scanning techniques (atomic force microscopy (AFM)) and microscopy ((scanning) transmission electron microscopy (STEM and TEM) have been employed. Subsequent to deposition also the electronic and conformational structure have been analysed because these are the two properties which are believed to play the crucial role for catalysis. Metastable induced electron spectroscopy (MIES) has been used for determining the electronic structure of deposited clusters. Results of catalytic reactions will be shown.</p>
5. Activity schedule and Indo-Australia workshop	<p>Annexure I</p>

6. Meeting Physics faculty, Laboratory and research facility visited (with Photo)	Annexure II
7. Interaction with Students	Annexure-III
8. Faculty members and researcher Interaction	Faculty interaction meeting (Annexure-IV) Individual meeting with faculty for research collaboration
9. Outcome from the visit	Annexure – V

Dr. Pushpendra Kumar

Name and Signature of coordinating faculty

Annexure I

Activity Scheduled

Date/day	Activities
Aug. 12/ Saturday	Arrival at 16:05 hrs
Aug. 13/ Sunday	Indo-Australia workshop on “Nanostructured Materials and its Application”
Aug. 14/ Monday	Discussion with faculty members on photo catalysis process, synthesis of TiO_2 , ZnO_2 nanomaterials and on XPS technique
Aug. 15/ Tuesday	Independence day celebration, discussions and Jaipur visit
Aug. 16/Wednesday	Interaction with student clubs (Science club, Mathematic club, IEEE and IETE student chapter, OSA) and visit to labs
Aug. 17/ Thursday	Students interaction focusing on Student Exchange projects A presentation by Prof. Gunther about the student exchange program b/w Manipal and Flinders University
Aug. 18/ Friday	Interaction with Faculty members regarding research activity on renewable energy
Aug. 19/ Saturday	Discussion on future research collaborations with faculty members
Aug. 20/ Sunday	
Aug. 21/Monday	Meeting with officials, interaction with individual faculty
Aug. 22/ Tuesday	Departure at 1:00 pm

Indo-Australia Workshop held on August 13, 2017



Delivered a Lecture on Metal Clusters on Semiconductor Surfaces



Annexure II

Meeting with Faculty of Physics on August 14, 2017



Following points were discussed during the meeting

- Prof. Gunther suggested involvement of more faculty in future research collaboration
- Gunther identified few faculty members for further research collaboration on nanoporous materials that include metal oxide and others
- Capable students who wish to do research may have possibility of 3-6 month project work at Flinders University and may join sandwiched PhD program (funding modalities to be decided)
- Identifying 2 project that can further be extended for Indo-Australia research collaboration

Lab visits on August 16



Annexure III

Interactions with Students

Following Points were discussed in the meeting

- Prof Gunther advised the students not be shy in asking questions. He gave some examples of Australian students.
- Students asked about how to incorporate particularly BSc and MSc students of MUJ in Australian education system. Prof. Gunther made a comparative chart of education system of both the sides and elaborated how to fill the gaps from either side.
- One student of MSc (By Research) asked about completing his research project at Flinders university, Prof agreed on that under the condition that living cost at Australia has to be met by the student/some funding agencies
- Prof. Gunther emphasized upon one fact that Australia is very safe place for Indian students without any gender bias.
- Several students have shown the interest and wished to explore the opportunity for their research at Flinders University Adelaide Australia through some scholarship at Flinders University.



Annexure IV

Interactions with Faculty members

Following Points were discussed in the meeting

- Faculty members from the Chemistry Department discussed about the research areas with Prof Gunther.
- Faculty of Bio-Sciences interacted with Prof. Gunther on particular areas of their research.
- Faculty members of Mathematics, management, and ECE department discussed about their areas of expertise.
- Prof. Gunther talked to individual faculty members on the specific research topics of the concerned teacher.
- With some of the research areas of he was quite impressed and indulged into deep discussion asking questions and finding the possible solutions which the researchers at MUJ are dealing with.



Annexure V

Outcome of visit

During the visit of Prof. Gunther Andersson from Flinders University Adelaide, Australia for the period of August 12-22, 2017 numbers of meetings with students and faculty members of MUJ were held focusing on research and student exchange possibility between the two universities. Prof. Gunther also had meeting with faculty member individually. The concluding remarks of these meetings are as follows:

1. With Prof. Gunther's initiative, a new collaboration between Dr. Ashima from MUJ and Prof. Ingo Koeper from Flinders University Adelaide, Australia has been discussed and Prof. Ingo has kindly agreed to be a co-supervisor for her Ph. D. students for scholarship at Flinders University.
2. A project ferrate battery based on porous silicon has been written and discussed in details where the involvement of Prof. Joe Shafter from Flinders University as Researcher will be mentioned as foreign Co-Investigator in the project proposal. The accommodation, local transport and living cost of two foreign researchers (faculty/student) during the visit to India for one month for collaborative work can be considered in project proposal budget.
3. A joint paper that include Dr. Pushpendra Kumar and Prof. Gunther has been written and discussed in details.
4. The graduate students of MUJ have discussed with Prof. Gunther about the possibility of summer internship at Flinders University Adelaide, Australia and how the internship program can be more effective for both University was discussed in the details.
5. The researcher from Manipal University Jaipur can collaborate and use the facility of Flinders university vice-versa.
6. The students from Flinders University can also visit the Manipal University Jaipur for research purpose.
7. Dr. Sushil Jain will synthesize semiconducting nanomaterials by sol gel route at MUJ for collaborative work at Flinders University. He is in touch with Prof. Gunther.