INDIAN INSTITUTE OF METALS

KANPUR CHAPTER

Annual Report (2013-2014)

Prepared By:

Dr. Shashank Shekhar

Secretary, IIM Kanpur Chapter

2013-2014

Annual Report (2013-2014)

April 12th, 2014

Dear Members of the IIM Kanpur Chapter and Friends,

IIM Kanpur has continued to grow in 2013-2014, as in previous years. The current executive committee took over in May 2013 and organized several events in past one year. It received huge support from all the past and present members and is immensely thankful to them. Some of our achievements in the current year are as follows:

- Poster competition was organized for the first time and it received very enthusiastic response from PG as well as UG students
- Metallography contest was also organized for the first time and saw an overwhelming response from students across the discipline with more than 100 entries taking part in the competition
- N.K. Batra Memorial Quiz was organized and the graduate students also put up some materials science based demonstration for the students
- Several events were organized where students mainly from IIT Kanpur and CSJM University, participated actively
- Several seminars/ guest-lectures were organized for the benefit of the students and the materials science community at large
- IIM Kanpur Chapter had its account audited, for the first time

The details of the various events are enclosed in the report, herewith.

The success of the aforementioned events goes rightfully to the energetic student members who worked very hard to make the events successful. In the end I would like to thank all the executive members and volunteers who have worked tirelessly throughout the year to take the IIM Kanpur Chapter to greater heights. I am certain that everyone, including me would extend the same support to the new executive council which will take over in May 2014.

Sincerely

Shashank Shekhar

Secretary, IIM Kanpur Chapter

Executive Committee (for the year 2013-2014)

In the last Annual General Body Meeting of IIM Kanpur Chapter which was held on April 12th, 2013, following members were elected for the executive committee of the Kanpur Chapter for the year 2013-2014

Dr. Kantesh Balani	Chairman
Dr. Krishanu Biswas	Vice Chairman
Dr. Shashank Shekhar	Secretary
Dr. Kaustubh Kulkarni	Treasurer
Dr. Nilesh Gurao	Advisor, Student Affiliate Chapter
Dr. Gouthama	Member
Dr. Anish Upadhyaya	Member
Dr. Sandeep Sangal	Member (Ex-Officio)

Website of IIM Kanpur Chapter: **http://www.iitk.ac.in/mse/IIM/**

	Chair Prof. Kantesh balani kbalani@iitk.ac.in		Vice Chair Prof. Krishanu Biswas kbiswas@iitk.ac.in
	Secretary Prof. Shashank Shekhar shashank@iitk.ac.in		Treasurer Prof. Kaustubh Kulkarni kkaustub@iitk.ac.in
	Student Advisor Prof. Nilesh Gurao npgurao@iitk.ac.in		Ex-Officio (Head, MSE) Prof. Sandeep Sangal sangals@iitk.ac.in
	Member Prof. Anish Upadhyaya anishu@iitk.ac.in		Member Prof. Gouthama gouthama@iitk.ac.in
	Student Member (IITK) Mr. Abinav Varshney abhinavv@iitk.ac.in		Student Member (CSJMU) Ms. Akanksha Mohan Mohan_akanksha@yahoo.coin

Meetings Organized:

Executive committee of IIM Kanpur chapter met regularly to discuss and organize various events for the year 2013-2014.

1. May 5th, 2013
2. June 3rd 2013
3. July 3rd, 2013
4. July 22nd, 2013
5. Aug 10th 2013
6. Aug 14th 2013
7. Aug 21st 2013
8. Aug 29th 2013
9. Aug 31st 2013
10. Oct 7th 2013
11. March 14th 2014
12. April 8th 2014

Members Elected for the Year 2014-2015 (Confirmed during AGM on April 12th, 2014):

Kanpur Chapter

Chair:	Prof. Kantesh Balani
Vice-Chair:	Prof. Kaustubh Kulkarni
Secreatry:	Prof. Krishanu Biswas
Co-Secretary:	Prof. Shashank Shekhar
Treasurer:	Shri G P Bajpai
Student Advisor:	Prof. Somnath Bhowmick
Member:	Prof. Nilesh Gurao

Student Affiliate Chapter

President :	Mr. Prabhat Chand Yadav (Roll No. 13106065)
Secretary, IITK:	Ms. Shirin Sunil Meshram (Roll No. 13106030)
Treasurer :	Mr. Abhimanyu T O (Roll No. 13206061)
Secretary, CSJM:	Ms. Shipra Vajpai

A Report on “Talks organized at IIT Kanpur”

IIM Kanpur chapter has been very active in organizing seminar talks by eminent scientists and researchers in the field of materials science for the benefit of graduate and undergraduate students in the field of materials science. Many of these talks were video recoded and are made available on website for the benefits of students. Some of the talks organized this year along with their abstracts are listed below:

1. **Prof. Pradeep Kumar Rohatgi,** Wisconsin and UWM Distinguished Professor and Director, UWM Center for Composites and Advanced Materials Manufacture
   College of Engineering and Applied Science, University of Wisconsin-Milwaukee

   Topic: **Hydrophobicity in Metallic Alloys and Composites**

   Date: March 10th, 2014

   Abstract: A lot of attention has been given to self-cleaning and anti-wetting materials in the last few decades. Some of the methods that have been used in producing self-cleaning surfaces on materials are lithography, etching, deformation, deposition and transfer methods. Based on the above, two main requirements for a self-cleaning surface are that the surface should be rough and should have low energy.

   Thermal oxidation is simply a reaction of a substrate with oxygen, controlled by the temperature parameter. When metals and their alloys are involved, metal oxides are formed. These oxides could be bulk or nano size depending on the growth conditions such as temperature, time, metal catalyst and gas atmosphere. Varying forms of oxides have been formed from thermal oxidation and have shown unique physical and chemical properties. The oxide nanostructures could be in the form of nanowires, nanorods, nanobelts, nanosheets, nanoribbons and nanotube. It is expected that the oxide nanostructures such as wire, flakes and nanowalls will affect the surface roughness on a scale that is sufficient to raise the contact angle of oil and water. Equally, it should provide surface area for modification with low energy materials for superhydrophobicity and for other processes.

In this research, thermal oxidation and chemical oxidation of copper alloys in different oxidizing N_2-O_2 mixtures to generate surface morphologies that affected the wetting of the copper alloys have been studied. Additionally, composite materials, which have intrinsic heterogeneity in their microstructure, were also evaluated.

2. **Prof Sushil Mishra,** Department of Mechanical Engineering, IIT Bombay, Mumbai

   Topic: **Effect of stress state on texture development**

   Date: Jan 20th 2014

   Abstract: Development of crystallographic texture based on stress state and its effect on the formability of low nickel austenitic stainless steel was studied experimentally and numerically. Limiting dome height (LDH) tests and FEM simulation were carried out to produce Strain path diagram. Microstructural studies were performed on the materials using EBSD and X‐RD techniques. To understand the texture development and its effect on forming behaviour of the materials artificial textures were generated. Different algorithms were used for tailored microstructures generation, which are either textured or uniformly random. Grains are produced via Voronoi‐ tessellation of uniform randomly generated nuclei in two dimensions while the grain orientations are assigned based on the constraints such as type of texture or randomness. At different stress state material properties were analyzed for experimental and simulated microstructures.

3. **Prof. N.K. Mukhopadhyaya,** Department of Metallurgical Engineering, IIT BHU

   Topic: **Inverse Hall-Petch behaviour in nanostructured $Al_{62.5}Cu_{25}Fe_{12.5}$ quasicrystals: A new Phenomenon**

   Date: Dec 27th 2013

   Abstract: The structural and mechanical stability of quasicrystals (QC) are important issues for their applications at high temperatures and stresses. The aim of the present talk is to review the earlier work and also to report the results and the analysis on the Hall-Petch (HP) and inverse Hall-Petch (IHP) like behavior of nanomaterials including quasicrystalline phases. It is found that the hardness increases with decreasing grain size down up to 40 nm, exhibiting the HP

relationship, whereas for grains smaller than 40 nm, IHP behavior is identified. This is attributed to the complexities of the structure and deformation mechanisms in quasicrystalline alloys. The IHP behavior in the nano-quasicrystalline phase could be attributed to thermally activated shearing at the grain boundaries, leading to grain boundary sliding mechanisms in nano-scale microstructured quasicrystalline grain boundaries. These results are analyzed based on the dislocation pile-up model as well as the grain boundary shear models applicable to nanomaterials.

4. **Dr. R. N. Patra,** CMD, IREL

Topic: **Beach Sand Minerals processing for materials – prospects and challenges**

Date: Nov 30th 2013

Abstract: Beach sand minerals (BSM) are a suite of seven minerals viz. ilmenite, rutile, leucoxene, zircon, sillimanite, garnet and monazite. These minerals are also known as Heavy Minerals (HM), as their densities range between 3.2 to 5.2 gram/cc which are higher than that of silica or quartz constituting the bulk of gangue materials in the beach sand. The first three of these minerals are titanium bearing minerals and they are mostly oxides of iron and titanium. The next three are silicates of zirconium (zircon), aluminium (sillimanite) and iron aluminate (garnet). The last of the BSM is a phosphate of rare earths and thorium which render the mineral radio-active and is the only commercial source of rare earths in India.

The BSM are separated from each other to their mineralogical purer forms by taking advantages of their differences in size, density, electrical and magnetic properties. The titanium, zirconium and rare earths find vast number of applications in ceramic metallurgical, phosphor, magnetics and electronics sector, where as thorium is a potential source of future nuclear power generation in India.

The subject matter of the talk focuses on prospects and challenges in developing the process technologies of various value added products from these minerals and their myriad of applications in the above mentioned industry sectors which are ever evolving with time. During the 30 minutes of my deliberations, I will attempt to highlight the main technological challenges in developing various value added products based on these minerals.

5. **Dr. Dileep Singh,** Argonne National Laboratory, Argonne, IL, USA

   Topic: **Residual Stresses and Adhesion Energy Measurements in Thin Tribological Coatings**

   Date: Nov 26th 2013

   Abstract: Thin hard ceramic coatings with low coefficient of friction are being developed for variety of applications, including vehicle engine components such as valve trains to enhance component life times and reduce parasitic energy losses. Long-term performance of coatings is dependent on the residual stresses generated in the coatings and its consequence on the coating adhesion on the metal substrate. In this presentation we will discuss the various x-ray based approaches used to measure residual stresses in nitride and carbide based thin (<5 μm) coatings deposited on steel under various processing conditions. Correlations will be made between the measured residual stresses, processing conditions, and the adhesion energies to gain insight into coating reliability. Finally, results from preliminary tribological testing will be presented.

6. **Dr. Geert Vanhoyland**, Bruker AXS, Karlsruhe, Germany

   Topic: **High resolution XRD for thin films and SAXS**

   Date: Nov 23rd, 2013

   Abstract: Dr. Geert Vanhoyland talked about high-reoslution XRD for thin films and small angle X-ray scattering (SAXS).

7. **Mr. K. V. Mani Krishna,** Scientific Officer, Materials Science Division, Bhabha Atomic Research Centre, Mumbai
   Topic: **Reconstruction of parent phase by modeling**
   Date: Sep 6th 2013
   Abstract: Reconstruction of parent phase by modeling

8. **Dr. Amol Gokhale,** Director, DMRL, Hyderabad

   Topic: **The keystone for technology marvels**

   Date: Sep 1st, 2013 (organized with Batra Quiz)

   Abstract: Dr. Golkhale gave talk on keystone of technology marvels, which detailed on various kinds of materials and technologies used in wide variety of defense equipments.

9. **Dr. Raghvendra Tewari,** Materials Science Division, Bhabha Atomic Research Centre, Mumbai

   Topic: **Development of Nb-1Zr-0.1C Alloy for Structural Application in Nuclear Reactors**

   Date: Aug 23rd 2013

   Abstract: India is pursuing work on Compact High Temperature Reactors which are envisaged to be used in remote areas for periods of 15 years in unman condition. These reactors will be operating at 1000°C and will be using liquid Pb-Bi as coolant. Under such harsh conditions, alloys which can withstand liquid metal corrosion as well as show adequate strength at these temperatures are few in numbers. Nb based alloys are proposed as structural materials for such reactors. In various Nb-Zr-C alloys, the Nb-1%Zr-0.1%C alloy shows best high temperature properties. The key to the development of an Nb-Zr-C alloy lies in the evolution of the carbide phases. Investigations on various carbide phases suggest that metastable carbides form during initial stages of the carbide formation. Details of the formation of these phases, especially the formation of different metastable precipitates prior to the formation of equilibrium phase and the subsequent structural changes will be presented in the talk.

   Another issue related with the technology of producing these alloys at industrial scale is due to the fact that alloys are formed, shaped at a temperature range close to 1500°C. However, technology of hot working at such high temperature does not exist in India. In order to produce products at large scale it is necessary to find out a working window at low temperatures. Therefore, in this talk a new approach of working at low temperature and development of a completely new flow sheet will also be discussed.

10. **Dr. Umesh Tiwari,** Panalytical, Singapore

    Topic: **Small angle scattering and High-resolution XRD**

    Date: Aug 22nd, 2013

    Abstract: Small angle scattering and High-resolution XRD

11. **Prof. Indranil Manna,** Director, IIT Kanpur

    Topic: **Novelty of Steel: Microstructure-Property Correlation**

    Date: April 12th 2013 (IIM AGM 2013)

    Abstract: Steel, an interstitial solid solution of carbon in bcc iron (without/with alloying addition), is one of the oldest and second most widely used material (tonnage wise) in all kinds of structural applications. The utility of steel primarily lies in its unique ability to offer an extremely wide range of mechanical properties covering hardness, strength, ductility, formability and toughness under various types, directions, conditions and rates of loading at ambient or elevated temperature. Variation in properties is designed either by changing the composition (alloy steel) or by tailoring the microstructure through carefully controlling the processing parameters, which are mostly thermo-mechanical in nature. Understanding and employing such tailoring of microstructure require intelligent use of thermodynamic and kinetic principles, exploitation of a range of diffusive/shear assisted phase transformations and application of microstructural and spectroscopic tools at various levels of resolution and magnification. In the present talk, results from recent studies will be presented to highlight development of a high carbon low alloy bainitic steel with duplex nanometric bainite+martensite phase aggregate and scope of further improvement of wear resistance by laser assisted surface engineering.

A Report on Prof. N.K. Batra Metals and Materials Quiz

Sep 1st, 2013 : Indian Institute of Technology, Kanpur

Prof. N. K. Batra Metals & Materials Quiz – 2013 was successfully organized jointly by the Department of Materials Science and Engineering, IIT Kanpur and IIM Kanpur chapter on Sep 1st, 2013, at Outreach Auditorium, Indian Institute of Technology, Kanpur, was a huge success.

This was the *fourteenth edition* of the metals and materials quiz organized at IIT Kanpur. Twenty six teams from thirteen different schools/inter colleges from in and around Kanpur participated in the competition. The proceeding of the event began with lighting of the lamp by Prf. Krishanu Biswas (Vice-Chairman of local chapter), Prof. Indranil Manna (Director of IIT Kanpur) and Chief guest Dr. Amol Gokhale (Director, DMRL, Hyedrabad).

A crossword puzzle was given to the twenty-six participating teams to select eight teams which then moved on to the semi-final rounds. Four teams selected from semi-final rounds advanced to the final rounds. Based on the overall performance, Abhishek Pradhan and Rajat Pandey of Sir Padampat Singhania Education Center were declared winner, while Hitesh Kumar Sharma and Aditya Kumar Singh of Kendriya Vidyalaya Armapur were declared runner-up. The quiz was coordinated by Prof. Kaustubh Kulkarni and Mr. Sankalp Verma of IIT Kanpur and Ms Akanksha Mohan of CSJM university.

For the first time, a poster competition was also organized along with this event, coordinated by Prof. Nilesh Gurao and Mr. Sandeep Sahu of Department of Materials Science and Engineering, IIT Kanpur. This event also had an

overwhelming response not only from graduate students but also from the undergraduate student community. The poster-competition had joint-winner in Mr. Ankur Gupta of Mechanical Engineering and Ms Swapnil Agarwal of Materials Science and Engieereing.

During the event, some science experiment demonstrations were also held for school students. The motivation behind these events was to encourage and motivate students towards understanding materials and science behind it. This event was also a greatly liked by school students as well as by graduate students.

The convention of holding a popular technical lecture related to materials science and engineering every year during Prof. N.K. Batra Metals and Materials Quiz, was continued with a lecture by Dr. Amol Gokhale, Director, DMRL, Hydrabad. He gave a fascinating talk on "*The Keystone of Technology Marvels*" which detailed on various kinds of materials and technologies used in wide variety of defense equipments. The talk was highly appreciated by students and teachers alike. Prof. Krishanu Biswas concluded the event with vote-of-thanks to all the volunteers and participants.

Student contingents from various schools participating in Prof. NK Batra Quiz 2013

Students working on the Crossword round to qualify for the semi-finals berth

IIM Student members showing simple science demonstrations to school students

Dr. Amol Gokhale's talk on "*The Keystone of Technology Marvels*"

A poster-competition was also organized along with the Quiz

A Report on "METAQUIZER-2013"

April 19th 2013 : Chhatrapati Sahu Ji Maharaj University, Kanpur

The chain began with the METAQUIZER, a quiz competition based exclusively related to Material Science and Metallurgy. It was held in the premises of UIET, CSJM where around 30 students participated for the initial written round followed by 7 teams formed amongst them. Total six levels where to be cleared to win the competition.

First round was a general round open for all the teams. In the second round was Assemble-O-Terms where each team was to arranged the jumbled terms based on one line clue within 10 seconds. There were other levels like the picture identifier followed by True and False. Semi-final level was amongst last 4 qualifying teams which was FROM THE SPELL, where each team was given two chances for answering. Initially a general description / definition of a term followed by a picture related to the term. This round was real fun to both the sides, for that of audience and the participants.

Final level was a rapid fire round named QUEST AT ZEST which was finally won by the team comprising of two boys **Chaman Srivastava** and **Ayush Mishra**. **Prasun Agnihotri** and **Kushagra Singh** turned up as runner ups. They were awarded by IITK faculty Dr. N.P. Gurao who also wished the students for their bright future.

Prof. N. P. Gurao with participants and volunteers

A Report on "Artistic Micrography Contest"

March 13th, 2014 : Indian Institute of Technology, Kanpur

It was jointly organized by Indian Institute of Metals (IIM), Kanpur Chapter and Materials Advantage (MA), where science and creativity both were displayed at its best. The microstructure submissions had to be comparable enough with any artistic thing possible on this earth or beyond.

More than 100 entries were received contesting to be a winner. Participation at this level turned out to be a great success for the event. The winners of the event were

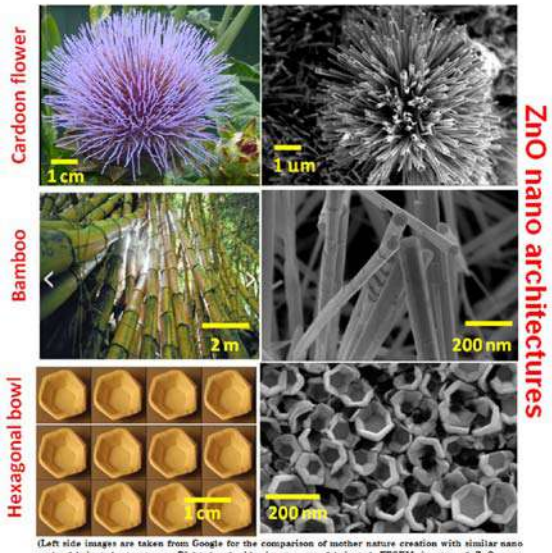
1. **Ankur Gupta** (Entry 81), PhD student, ME

2. **Kunal Mondal** (Entry 04), PhD student, ChE

3. **Nitesh Kumar** (Entry 92), PhD student, MSE

Faculty of various departments along with participants and volunteers

Metallurgy
Materials Engineering

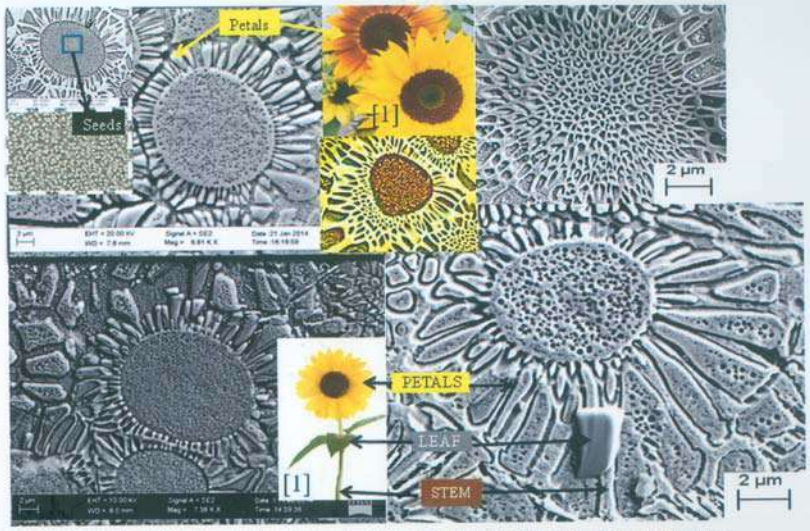


(Left side images are taken from Google for the comparison of mother nature creation with similar nano scale fabricated structures. Right hand side images are fabricated FESEM images of ZnO nano architectures)

Ankur Gupta (PhD Student),
Supervisor: Dr. Shantanu Bhattacharya, ME, IIT Kanpur

Microscopic Sunflowers

Nitesh Kumar, Anshul Gupta and Anandh Subramaniam



SEM Micrograph showing Flower type morphology in Al Cr Fe Ni High Entropy Alloys. Seeds are rich in Al and Ni while Petals are rich in Cr and Fe. SE and BSE images are shown to analyze surface topography and compositional variations . EDX Colour mapping is also shown.

[1] http://www.wallfloweronline.com/product/yellow-sunflower/

Nano-necklace
1 µm
Mag = 19.88 K X
WD = 2 mm
EHT = 10.00 kV
Signal A = InLens
Date :6 May 2012
Time :23:01:12
ZEISS
Necklace

A Report on "A talk on Sintering of Materials"

March 28th 2014 : Indian Institute of Technology, Kanpur

Dr.Krishanu biswas was invited for a talk to be given to undergraduate students from IITK and CSJM University. The topic was related to sintering of materials. In the talk he began with the basic need for powder metallurgy followed by the process of formation of powders for fabricating materials. Further sintering was brought into light. He also explained to students, various types of sintering and science behind it.

IIM
Metallurgy
Materials Engineering

STATEMENT OF ACCOUNT (as on 31/03/2014)

Kanpur Chapter of Indian Institute of Metals

Financial Year 2013-2014 (From 01 Apr 2013 to 31 Mar 2014)

Bank Account Number: 10426004917 (at SBI, IIT Kanpur)

Details of Receipt

S. No.	Date	Particulars	Amount (Rs.)
1	01/04/2013	Opening Balance	63505
2.	19/09/2013	Chapter Grant	7430
3.	25/04/2013	Interest From FD	2299
4.	30/06/2013	Interest Credit	1409
5.	31/12/2013	Interest Credit	1215
6.	31/03/2014	Balance from Student Affiliate chapter	26
Total Credits			**75884**

Details of Expenditure

S. No.	Date	Particulars	Amount (Rs.)
1.	09/04/2013	Snacks for IIM Chapter committee Meeting	142
2.	12/04/2013	Stationary, printouts and binding for IIM Chapter GBM	442
3.	22/04/2013	Hall rent for GBM	750
4.	31/05/2013	MCC Issue Fees by SBI	100
4.	08/07/2013	Envelops and Photocopies	444
5.	19/07/2013	Postal charges	935
6.	27/07/2013	IIM Committee meeting refreshments	199
7.	31/08/2013	Preparation, material and miscellaneous for Demo during N. K. Batra Quiz	3071
8.	31/08/2013	Snacks and chocolates	1040
9.	31/08/2013	Stationary, print outs and miscellaneous for N. K. Batra Quiz and Poster session	2437
10.	01/09/2013	Welcome, Travel and Conveyance of Guest Speaker of N. K. Batra Quiz	3199
11.	01/09/2013	Cash Prizes for winners of N. K. Batra Quiz and Poster session	6500
12.	26/11/2013	IIM Seminar	1254
13.	12/12/2013	Postal Charges	67
14.	28/03/2014	Refreshments	616
Total Expenditure			**21196**

CLOSING BANK BALANCE

As on 31.03.2014: Rs. 54688 (SB a/c)

ASSETS: 1. Special term Deposit, SBI, IIT Kanpur: Rs.30, 000 (reinvested)

2. Special Term Deposit, SBI, IIT Kanpur: Rs.1, 00,000 (reinvested)

Kaustubh Kulkarni
Treasurer, IIM Kanpur Chapter

Shashank Shekhar
Secretary, IIM Kanpur Chapter

Kantesh Balani
Chairman, IIM Kanpur Chapter

STATEMENT OF ACCOUNT (as on 31/03/2014)

Student Affiliate Chapter at Kanpur Chapter of Indian Institute of Metals

Financial Year 2013-2014 (From 01 Apr 2013 to 31 Mar 2014)

Bank Account Number: 10426004917 (at SBI, IIT Kanpur)

Details of Receipt

S. No.	Date	Particulars	Amount (Rs.)
1.	19/09/2013	Student Chapter grant + Student Affiliate Chapter Grant	12200
Total Credits			**12200**

Details of Expenditure

S. No.	Date	Particulars	Amount (Rs.)
1.	08/04/2013	Awards for Metaquizer at CSJMU	2900
2.	09/04/2013	Photo Copies and Print outs for Metaquizer	1499
3.	09/04/2013	Snacks for Metaquizer	831
4.	09/04/2013	Auto rickshaw fare	60
5.	12/04/2013	Stationary	710
6.	30/08/2013	Poster session display rent	500
7.	07/03/2014	Color print outs of flyers and posters	1200
8.	13/03/2014	Stationary and print outs for Artistic Micrography Contest	221
9.	13/03/2014	Snacks during Artistic Micrography Contest	1003
10.	22/03/2014	Color print outs of flyers and posters	1000
11.	28/03/2014	Foyer booking for Artistic Micrography Contest	2000
12.	28/03/2014	Display panels renting for Artistic Micrography Contest	250
Total Expenditure			**12174**

CLOSING BALANCE:
As on 31.03.2014: Rs. 26

Kaustubh Kulkarni
Treasurer, IIM Kanpur Chapter

Nilesh Gurao
Faculty Advisor, Student Affiliate Chapter

Shashank Shekhar
Secretary, IIM Kanpur Chapter

Kantesh Balani
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