



# Indian Institute of Technology Bombay

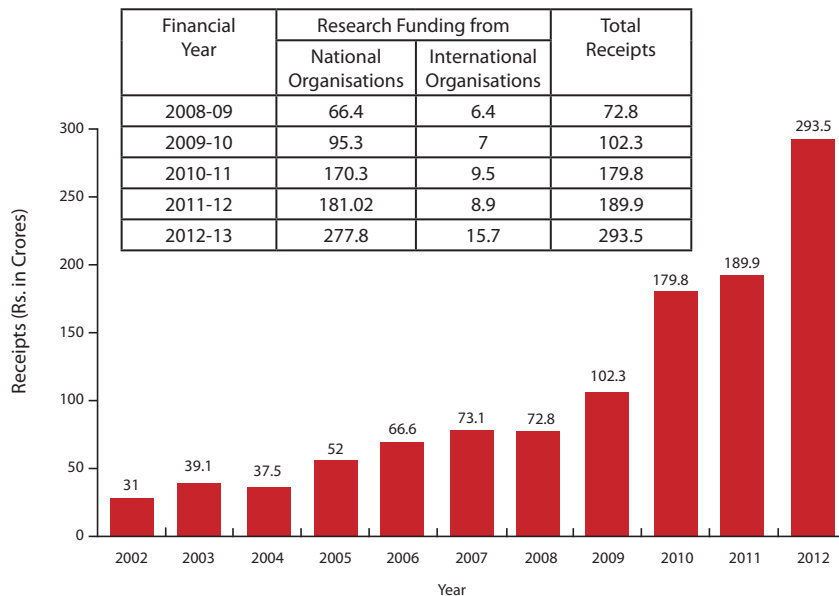
## Research & Development

IIT Bombay has seen significant growth in R & D funding, Ph.Ds, patents and publications in the last decade.

### R & D Indicators

#### R & D Fund Growth

Rs. in Crore (1 Crore = 10 Millions)



No. of Faculty (as on 30th June, 2013)	565
No. of PhD Degrees Awarded (in 2012)	180
No. of Post Graduate Degrees Awarded (in 2012)	1027
No. of Under Graduate Degrees Awarded (in 2012)	799
No. of Indexed Publications (in 2012)	1331

#### Faculty Recognition

Shanti Swarup Bhatnagar Prize for Science and Technology	11
Padma Shri Award	2
Swarnajayanti Fellowship Award	9
Fellow, Indian Academy of Sciences, Bangalore	18
Fellow, Indian National Academy of Engineers, New Delhi	25
Fellow, The National Academy of Sciences, India (Allahabad)	27
Fellow, Indian National Science Academy, New Delhi	9

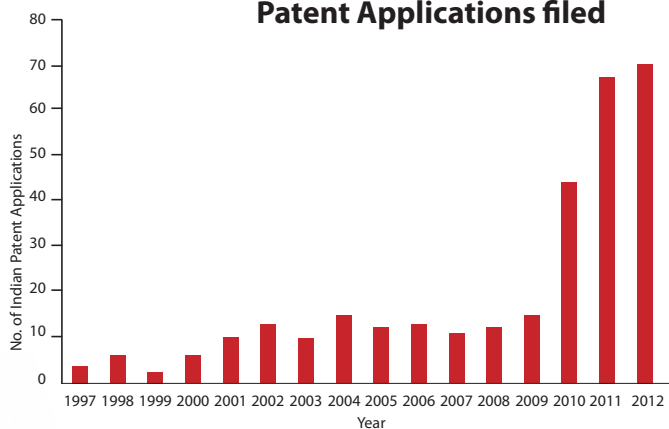
## Intellectual Property

(From 1st January, 1997 to 31st March, 2013)

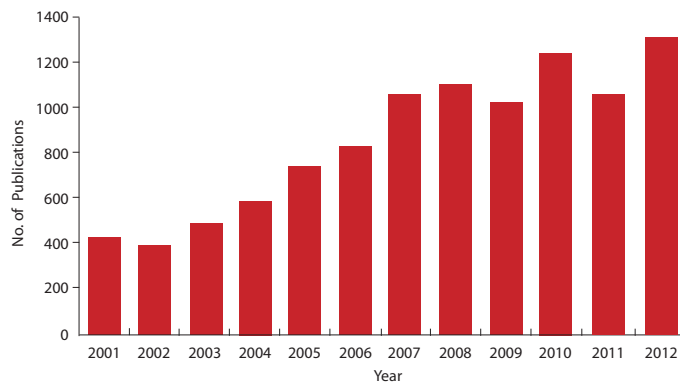
For the year 2012-13

Indian patent applications	327	Indian Patent Applications	70
Indian patents granted	75	PCT Applications	13
Foreign patent applications (US, Europe, Japan & others)	73	US Applications	6
Design & Trademark Registrations	27	EU & Brazil Applications	2
		Trademarks	2
		Copyright	1

### Patent Applications filed



### Peer reviewed publications

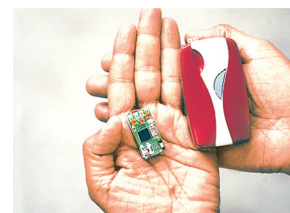


Source: Scopus, WoS, MathSciNet Data

## Licensing activities - Representative Examples

### Licensing of IP developed at IIT Bombay

- Board Games design
- CFD - Tutor
- Design analysis and simulation of batch distillation and pressure swing adsorption units
- Electro-Slag Refining Process
- Ethernet Switch Routers
- Inorganic – Organic – Hybrid Coatings
- WebNC for product design and process planning for CNC machining
- V-trough concentrated module



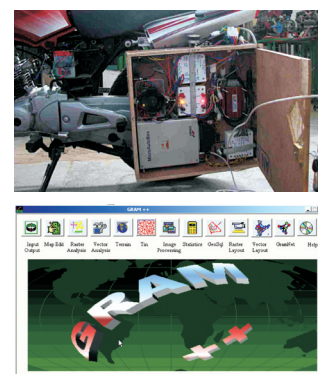
### Licensing through collaborative development

- Amplified Fluorescence Polymers as TNT sensors
- Asymmetric device applications in advanced CMOS technologies
- Design of ATM Enclosure - ASAN
- Fuel Additives-Thermal and Thermact technologies
- Laminated object manufacturing- rapid prototyping process
- Novel 3-in-1 heat pump for AC, hot water and potable chilled water
- Short Term Load Forecasting
- Silicon locket for cardiac monitoring
- Steer-by-wire system for vehicle

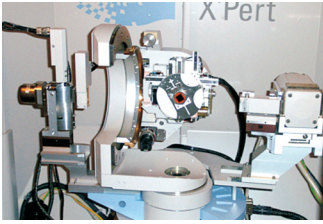
### Commercialisation through incubation

- InOpen Technologies Pvt. Ltd.
- Nanosniff Technologies Pvt. Ltd.
- Polymeric Sensors Pvt. Ltd.
- Sensi Bol Audio Technologies Pvt. Ltd.
- Vegayan Systems Pvt. Ltd.

For more technologies visit <http://www.iitb.ac.in/licensing>







Texture & Orientation Imaging Microscopy



Scanning Probe Microscope



Physical Property Measurement System

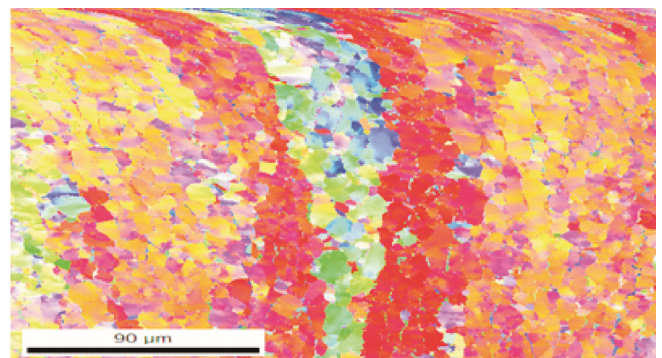
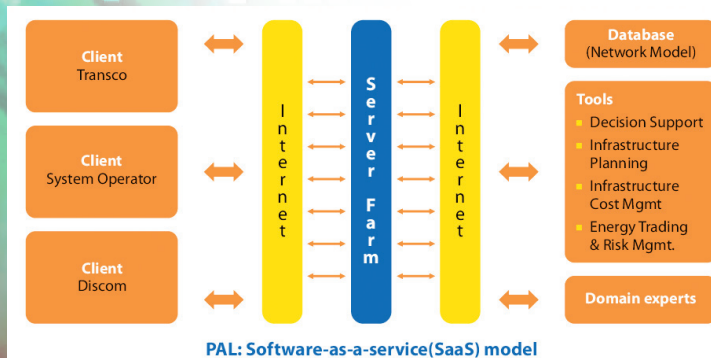


Geotechnical Centrifuge Studies Facility

- $^{40}\text{Ar}$ - $^{39}\text{Ar}$  Geo-thermochronology Facility
- Dielectric Broadband Spectrometer
- Electro-slag Refining Facility
- Gas Chromatograph High Resolution Mass Spectrometer
- High Resolution Mass Spectrometer
- NanoIndenter

### Research Centres / Consortia

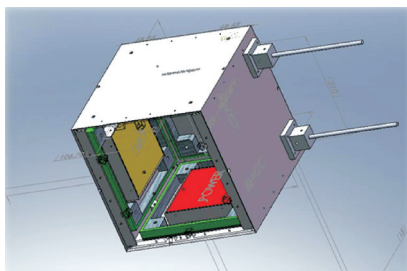
- Centre for Aerospace System Design & Engineering
- Centre for Excellence in Nanoelectronics and Indian Nano Users Programme
- Centre for Formal Design & Verification of Software
- National Centre for Aerospace Innovation and Research
- National Centre for Photovoltaic Research and Education
- National Mission on Education through Information and Technology
- National Solar Thermal Research, Testing and Simulation Facility
- Tata Teleservices-IITB Centre for Excellence in Telecommunications
- Geospatial Information Science and Engineering Lab.
- Power Anser Laboratory for Developing Knowledge Based IT Solutions for Electric Power Systems
- VLSI Research Consortium
- IIT Bombay- Indira Gandhi Centre for Atomic Research (IGCAR) Research Cell
- ISRO - IIT Bombay Research Cell
- Interdisciplinary Research Programme in Climate Studies
- Interdisciplinary research efforts in Healthcare, Combustion and Water
- Rural Technology Action Groups
- Research Designs & Standards Organisation - IIT Bombay Research Cell
- Interdisciplinary research centre for security



NCAIR: Electron back scattered diffraction image of machined surface on Aerospace Titanium

## Student Research Initiatives - An Example

### Pratham – IITB student satellite project



About 40 students from several departments are involved  
 Weight - 10 kg, Size: 26 x 26 x 26 cm, Orbit: 10:30  
 polar sun-synchronous, 817 km altitude  
 Payload: Total Electron Count using Faraday rotation, 2  
 downlinks, No uplink, fully autonomous,  
 4 months mission life.  
 ISRO collaboration for hardware and launch.

### Biosynth Project



30 member student team. On campus 300 L batch  
 biodiesel plant for providing hands-on plant-scale  
 experience to students by working on developing a  
 process for synthesis of biodiesel from waste vegetable  
 oil. Achieves the multiple aims of a research and teaching  
 project coupled with a green energy initiative.

## Research Partners

### Industry funding during FY 2012-13 : 27.84 Crores

- No. of industries interacted : 367
- Average industry funding : 7 Lakhs

#### Indian Industry:

No. 337, Total Receipts: Rs. 19.06 Crores

Beaver Infra Consultants Pvt. Ltd., Cummins India Ltd., DBM Geotechnics & Constructions Pvt. Ltd., Enviro Technology Limited, General Motors Technical Centre India Pvt. Ltd., Gharpure Engineering and Construction (P) Ltd., GMR Infrastructure Ltd., Indiabulls Power Limited, Intel Technology India Pvt. Ltd., Jaisu Shipping Company Pvt Ltd., Janssen Pharmaceutica N.V., Kirloskar Brothers Limited, Pune, Larsen & Toubro Limited, Maxim India Integrated Circuit Design Pvt. Ltd., Netapp India Private Limited, Nokia India Pvt. Ltd., Piramal Life Sciences Ltd., Reliance Industries Ltd., Samsung Electronics Ltd., Sumer Infrastructure Pvt. Ltd., Tata Chemicals Ltd., Tata Consultancy Services Ltd. Tata Steel Ltd., Tata Teleservices Ltd., United Phosphorus Limited, Vodafone Shared Services Ltd.,...

#### International Organisations:

No. 40, Total Receipts: Rs. 15.76 Crores

Applied Materials Inc., USA, Boeing Company, USA, Compatible Technologies International, USA, European Commission, EyeNetra Inc., USA, Ford Foundation, USA, GOOGLE, USA, Intel Corporation, USA, Intel Mobile Communications GmbH, Germany, International Business Machines Corporation, USA, International Institute for Applied Systems Analysis, Austria, McDonnell Academy, USA, NanoAxis, LLC, USA, Nokia Siemens Networks, Germany, Petro Gold International LLC, Dubai, Pratt & Whitney Co., Canada, Renesas Electronics Corporation, Japan, SAM Engineering LLC, Oman, Samsung Engineering Company Ltd., Japan, Semiconductor Research Corporation, USA, Siemens Power Generation Inc., USA, University of Pompeu Fabra, Spain, Wadhvani donation, USA, Xerox Corporation, USA,...

## Research that makes a difference

IIT Bombay is now looking beyond traditional R&D metrics of publications, patents, funding and is putting efforts to promote research that makes a difference. An internal brainstorming exercise involving various stakeholders (faculty, students & staff) identified several initiatives to set the R & D Agenda.

Some R&D initiatives undertaken/proposed are

- Attract best students to research
- Show case & Publicize R&D achievements
- Encourage Collaborative Research
- Enhance Patenting & Technology Transfer
- Western Regional Research Pool



### Contact:

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