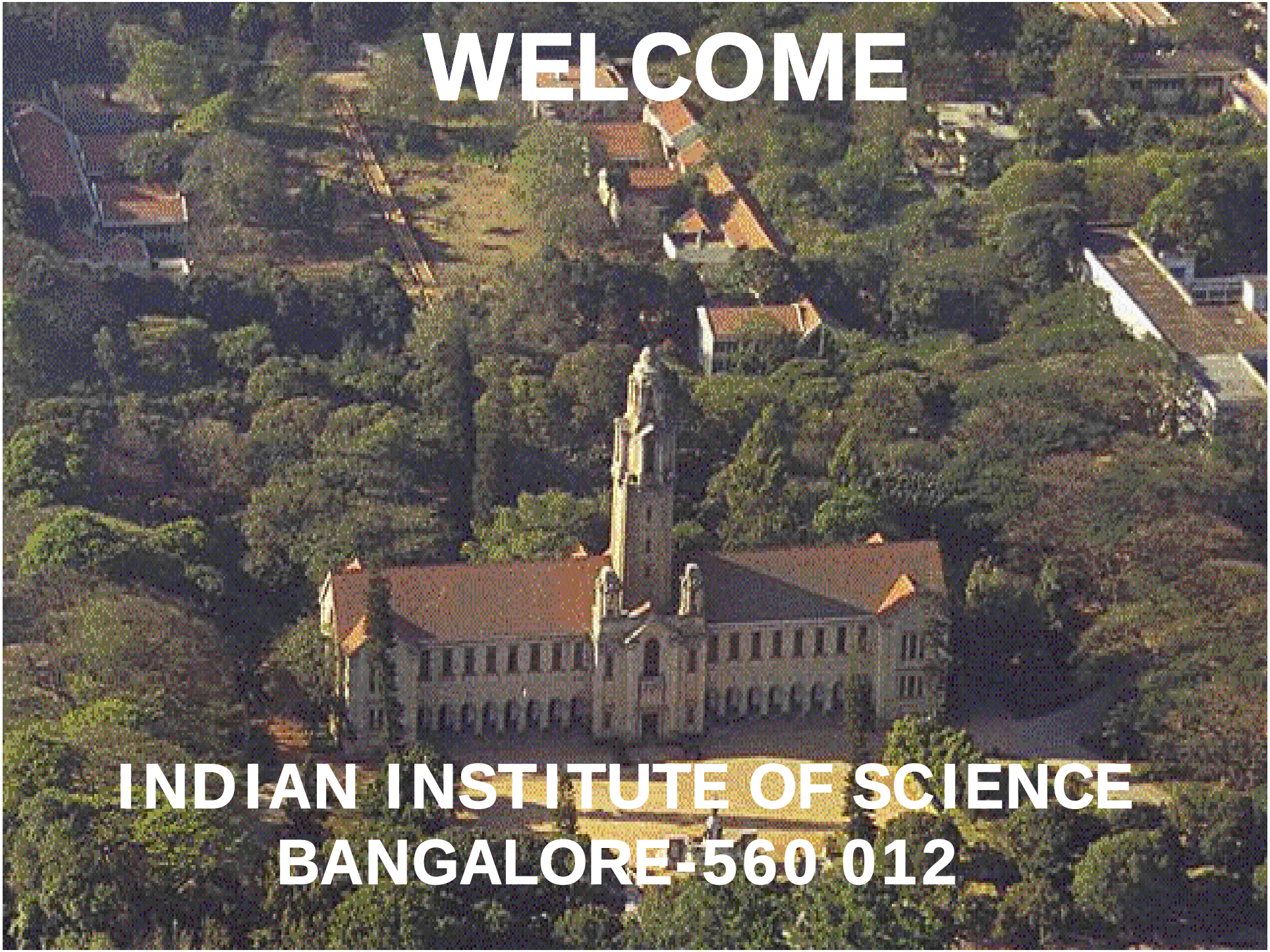
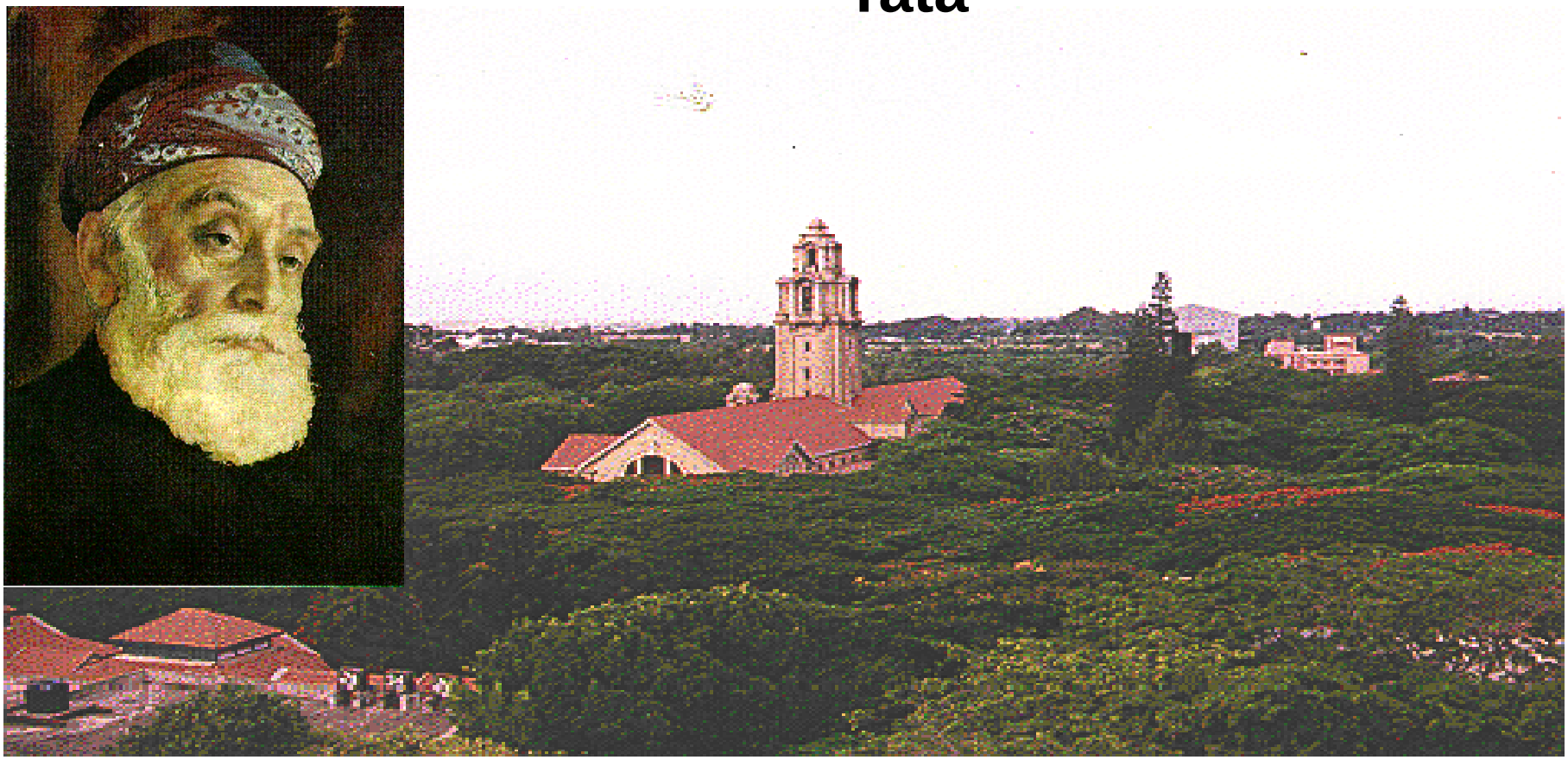

WELCOME
INDIAN INSTITUTE OF SCIENCE
BANGALORE-560 012

Conceived in 1896 by the inspired vision of the pioneering industrialist Jamsetji Tata



- Established in1909 as a Trust (Charitable Endowments Act 1890)
- Deemed University from 1957
- Funded by MHRD since 1993

Vision

Founder's mandate: Institute designed to promote original investigations in all branches of learning and to utilise them for the benefit of India.

21st century: to be among the world's foremost academic institutions through the pursuit of excellence and the promotion of innovation.

Residential intellectually vibrant campus

440-acre wooded campus

Land gifted by the Maharaja of Mysore Shri Krishna Raja Wodeyar

Exotic flora and fauna

Student and Faculty Profile

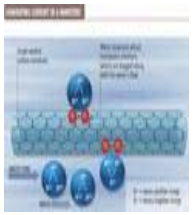
- Deans
- Faculties: Science and Engineering
- Students: ~2050 (Men ~ 1650 ; Women ~ 400)
- Research: (PhD, Int. PhD) ~ 1250
- Course: [ME, MTech, MDes, MBA, MSc (Engg.)] ~ 800
- Faculty: 321 (Academic) 114 (Scientific)

Student and Faculty Profile

- Faculty-Student Ratio ~ 1:5
- Research Degrees / year ~ 225
- Research Publications / year ~ 1367
- About 10% of the science and engineering publications from the country
- Academic visitors /year ~ 1000

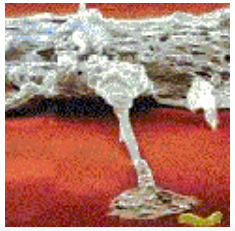
Divisions

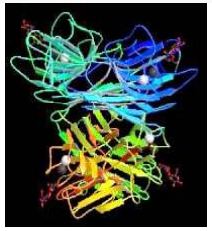
- Biological Sciences
- Electrical Sciences
- Mechanical Sciences
- Chemical Sciences
- Information Sciences
- Physical and Mathematical Sciences

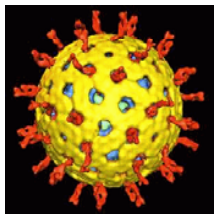


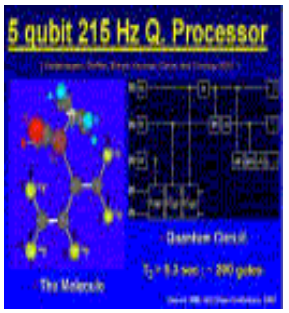
Research in Divisions: All frontier areas of science and technology

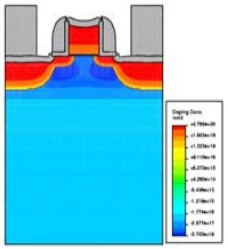
- **Biological Sciences: From Genomics, Structure, Proteomics to Ecology and Infectious Diseases**
- **Chemical Sciences: From Synthesis, Organometallics, Functional Polymers to Protein Folding, Strongly Correlated Oxides, Smart Materials, and FTNMR**
- **Electrical Sciences: From Communications, Networks, Signal Processing, RFMEMS, Microelectronics to Power Systems, Software, Automation, Computer Science, Architecture, and Internet Technology**



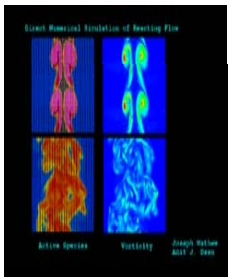




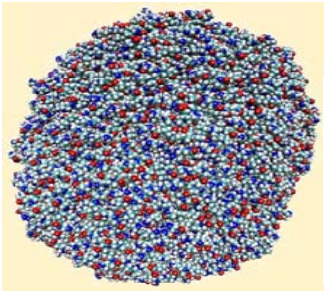


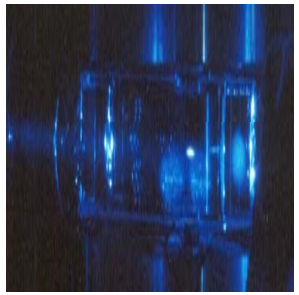


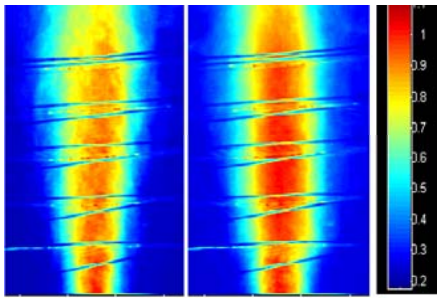
Research in Divisions: All frontier areas of science and technology

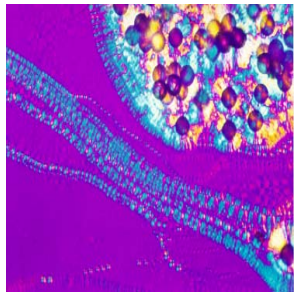


- **Information Sciences: High-performance computing, Database Systems, CAD, to Multimedia, High-Speed Networks, and Management.**
- **Mechanical Sciences: From Aerospace and Satellite Technologies, Robotics, Tribology, and Nanomaterials, to Water Resources, Climatology, and Sustainable Technologies.**
- **Physical and Math. Sciences: From Condensed Matter Physics, Biocrystallography, Cryogenics, and Astrophysics to Algebra, Topology, Nonlinear Dynamics, and Functional Theory.**









Introduction to CGPL

ABETS
Combustion Gasification Propulsion Laboratory
Indian Institute of Science
Bangalore

Background

- Part of Aerospace Engineering Dept
  - Involved in aerospace propulsion and combustion
    - Experimental
    - Computational
  - Associated with defence organisations, and other combustion groups, involved in the aerospace research programs

Renewable energy initiative

- Early 1980’s - look into the energy needs of agricultural sector through the route of gasification (as a part of activity of ASTRA)
- Both developmental and basic research activity

Research activities

- The broad areas include laminar premixed and diffusion flames, heterogeneous combustion, nozzle flows and combustion flow interaction in practical systems.
- Lifted diffusion flames, sandwich composite propellant burning, secondary combustion chamber modeling of RAM jets,
- Modeling of combustion in hybrid rocket engines and solid propellants and ingredients; combustion of liquid droplets and instability in liquid rocket engines; propagation of premixed flames with complex chemistry and diffusion; reacting flows in nozzles and air inlets in aircraft and missiles; combustion of wood in gasifiers and in stoves; of heat transfer in nuclear reactor system and large pressure vessels of petrochemical complex

Publications

- Over hundred publications in international journals covering wide aspects of basic and applied research
- One of the few groups in the international scene to represent in International symposium on combustion (from 1980 onwards)
- Students profile
  - No. of Ph D's thesis – 16
  - No. of M.Sc thesis - 6
  - No. ME's thesis - 44

Major events

- Biomass gasification activity – 1982+
- Phase I:
  - 1982 – 1986 - Open top, throat based system close to WW II class
- Phase II:
  - 1986 – 1994 Open top downdraft reburn system – issues of reactor materials and related design being sorted out
  - 1994 – Major Indo-Swiss test at IISc – 10 x 10 hrs – external inspection and analysis
  - 1996 – Major Indo-Swiss test in Switzerland – 10 x 10 hrs – analysis in 3 labs, one from India
  - 1996 – 2000 – Presentations of the science and the results in conferences and workshops in Banff, Canada, Stuttgart, Germany, RIT, Sweden, Riodegeneiro, Brazil, Italy,
- Phase III
  - 2002 - interaction with M/s Cummins

Research projects in the area of Energy sector

- Over 50 projects have been handled on research and development in the last 5 years (Approx. 40 M USD)
  - 1999 – Major project of MNES – Strategic Development of Bio-energy (SDB)
  - 2000 – NBRAP – Biomass Atlas
  - 2001 – Major project of MNES – Advanced biomass gasification – high pressure gasifier and gas turbine (with BHEL, IICT, IITM)
  - 1999 – Eliminating classical grate concept in favor of screw extraction of char/ash at the bottom
  - 2002 – Breakthrough in gas cleaning – C ^{n} system – chilling the gas to < 7 °C leads to a ultra clean gas (<ppb particulate and tar)

Technology packages developed

- Gasification of any biomass to electricity/heat.
- Package with electricity/heat + activated carbon (4 – 5 %)
- Package with electricity/heat + carbon (25 – 27 %)
- Precipitated Silica from rice husk/ash/char
- Biogas clean up (of hydrogen sulfide) to electricity via reciprocating gas engines)

Introduction to the training course

- Theme: Bioenergy
- Sponsored by MNES
- Includes both thermal and biological aspects of biomass conversion
- Structure
  - class instruction
  - experimental study through participation
  - field visits

Major topics

- Biomass resource
- Gasification for electricity and heat
- Combustion devices
- IC engines for producer gas, emissions
- Power generation — cogeneration, IGCC
- Economics of power generation, DPR preparation
- Biomethanation, liquid and solid waste management, operation and maintenance of plants

Discussion during the concluding session

- Presentation by the participants
  - Scope on bioenergy in the respective countries
  - Possible projects
  - Areas of cooperation
  - Feed back on the course
- MNES
  - MNES programs in India
  - MNES programs on country to country cooperation