



Complex Fluids & Polymer Engineering Group: An Overview

- Mission & goals
- Activities
- Philosophy & guiding principles
- Research focus
- Areas of experience
- Resources & facilities
- Achievements
- Current research focus
- Looking ahead
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Mission & goals

- To pursue research leading to mechanistic and quantitative understanding of structure-property relationships in complex fluids and polymeric materials.
- To exploit this understanding for the design and development of novel and improved materials and processes so as to benefit stakeholders of NCL.
- To contribute to decision making, institution building and strengthening of institutional mechanisms at various levels – NCL, CSIR and the industry.
- To pursue the highest standards of lab culture and practices.



Activities

- Curiosity-driven research
- Sponsored research
- Consultancy services
- Specialized training & continuing education
- Supervision of PhD theses
- Testing and technical services
- Building shared equipment facilities
- Developing specialized instruments

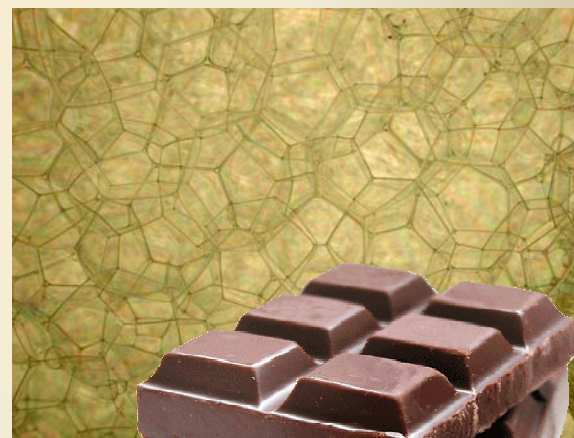


Philosophy & guiding principles

- Achieving synergy between curiosity-driven, client-driven and mission-mode research.
- Strive for quality and excellence in research output, deliverables to clients and funding agencies, project management and work practices.
- Align group goals to institutional goals and set up fruitful partnerships with other research groups at NCL.
- Actively seek out opportunities for inter-disciplinary research.



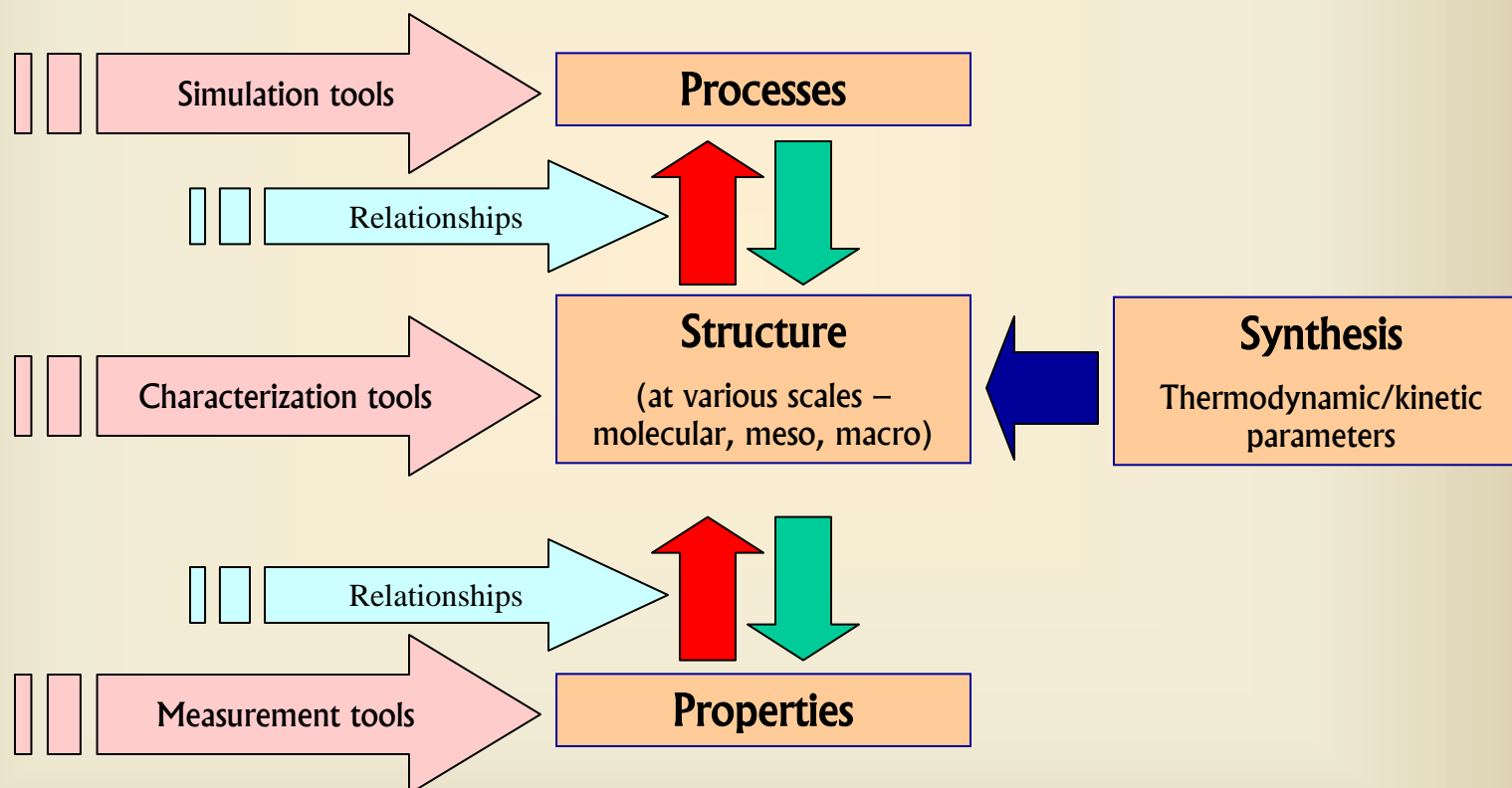
Research focus: Complex fluids





Research focus

Mechanistic and quantitative understanding of structure-property relationships in complex fluids





Areas of experience

- Experimental rheology of complex fluids
- Static and dynamic light scattering measurements and analysis
- SAXS measurements and analysis
- Rheo-optics, flow visualization
- Constitutive equations for entangled polymers
- Polymer processing, compounding and formulations
- Structure development during processing
- Stimuli sensitive hydrogels
- Colloidal photonic materials
- Biomedical materials
- Self-assembly and pattern formation in nanostructured materials
- Inorganic-polymer nanocomposites
- Radiation processing of polymers
- Protein-polymer interactions, food colloids
- Granular flow and suspensions
- Reaction-diffusion problems in polymeric systems



Resources and Facilities

- Rheology:

ARES, MCR301, SER, Gemini-II, Rheovis.

- Rheo+:

CSS450, TST350, SALS, FB, PTV

- Scattering:

Nanostar, 3D-DLS, Zetasizer, PCS

- Processing:

ZE-25, Sigma60, PolyLab, DSM-MC/MI





Achievements: Research

- Publications from CFPE members: > 75; Patents: 4
- SSB award, CSIR-YSA, INSA-YSA
- PhD theses (2009): 5 ; Current PhD students (2009): 10

Macromolecules **2002**, *35*, 1762–1769

Shear-Enhanced Crystallization in Isotactic Polypropylene. 3. Evidence for a Kinetic Pathway to Nucleation

Guruswamy Kumaraswamy,^{†,‡} Julia A. Kornfield,^{*,‡} Fengji Yeh,[§] and Benjamin S. Hsiao[§]

ADVANCED MATERIALS



Biomaterials 23 (2002) 717–724

Biomaterials

www.elsevier.com/locate/biomaterials

Gradient crosslinking of UHMWPE using irradiation in molten state for total joint arthroplasty

Orhun K. Muratoglu^{*,*}, Daniel O. O'Connor^a, Charles R. Bragdon^a, John Delaney^a, Murali Jasty^a, William H. Harris^a, Edward Merrill^b, Premnath Venugopalan^c

^aOrthopaedic Biomechanics and Biomaterials Laboratory, Massachusetts General Hospital, Jackson 1206, 55 Fruit Street, Boston, MA 02114, USA

Macromolecules **2001**, *34*, 852–858

A Rheological Study on the Kinetics of Hybrid Formation of Polypropylene Nanocomposites

Girish Galgali,[†] C. Ramesh,[‡] and Ashish Lele^{*,†,§}

Chemical Engineering Division, National Chemical Laboratory, Pune 411 008, India
Polymer Chemistry Division, National Chemical Laboratory, Pune 411 008, India

Received March 29, 2000

Kawatsutsu
e propor-
the sinter-
r/10% H₂

Novel Macroscopic Self-Organization in Polymer Gels**

By Shyni Varghese, Ashish K. Lele, Darbha Srinivas, Murali Sastry, and Raghunath A. Mashelkar*

250

Macromolecules **2000**, *33*, 250–252

Influence of Stereoregularity on the Wall Slip Phenomenon in Polypropylene

Prashant S. Tapadia,[†] Yogesh M. Joshi,[†] Ashish K. Lele,^{*,†} and R. A. Mashelkar[‡]

Table 1. Molecular Weight Distribution of Polypropylene

Material	Molecular Weight (g/mol)
m.s.PP.1	1



Achievements: Industrial Projects

Clients:

- GE Plastics/Sabic
- Aditya Birla Group
- Reliance Industries Ltd., IPCL
- Owens Corning-ADC
- Cosmo Films
- Gharda Specialty Polymers
- DK Fiber Forms
- Alcoa

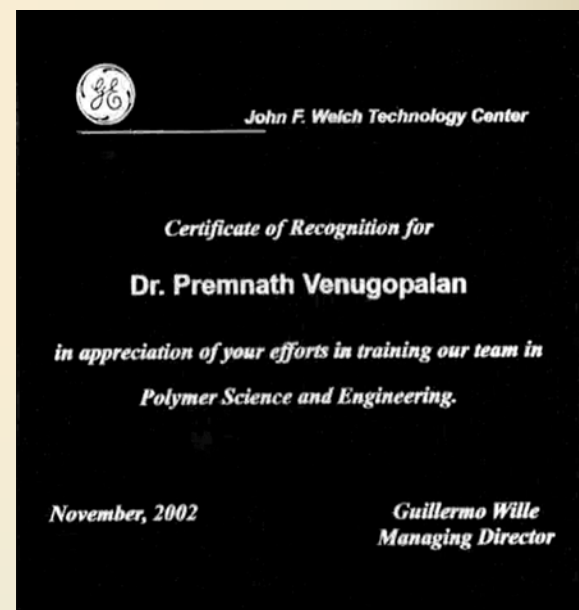
Funding:

- Average funding p.a. ~ Rs. 1.0 crore

Nature of projects:

- Sponsored research: development of tacit understanding
- Academic research
- Specialized training
- Consulting

- “Best practice...” award by GE
- High satisfaction ratings; Certificates of Recognition
- Repeat clients





Achievements: Technology development



Porous PE maxillofacial implants process know-how developed in-house and transferred to an entrepreneur. These implants have successfully penetrated Indian markets.



Pultrusion process know-how developed in-house and transferred to the client. Projects like the radio-wave transparent tower shown here have been executed by the company.



Achievements: Value-addition to clients

- Product improvement strategy for RIL products (RIL's estimate of value created = 9.4 crores; 8kT)
- Product knowledgebase; Improved understanding of phenomena relevant to products for GE and RIL
- Research & technology strategy report for RIL-IPCL
- Reports influencing decisions on R&D directions (GE, Cosmo Films)
- Industry professional trained: 308 (from Plant Engineer to Senior Group Vice President)

POLYOLEFIN MONITOR

JULY 2000

Issue

Polymer production, polym

- Highlights and con
- Business news (Se
- Scientific literatur
- Patent literature (S

Physical properties and m

- Highlights and con
- Scientific literatur

Plastics processing and ap

- Highlights and con
- Business news (Se
- Scientific literatur
- Patent literature (S

Plastic additives

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- Environ
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POLYOLEFINS

Technology for Competitive Advantage



Training program for the staff of:
Reliance Industries Limited.

Conducted by:
Polymer Business Group

The information in the polyolefin monitor is compiled from various sources: Chemical Business News (RSC), Chemical Abstracts (CAS) and various internet sources. The



Introduction to Polymer Science & Engineering

Wave 1: 22-24 April 2002

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Research & Technology Strategy for RIL-IPCL's Polymers Business

A Strategy Report of the RIL-IPCL-NCL Team
Presentation: Sept 2002
Final Report: Feb 2003

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Current research focus

- *Nanomaterials:*
 - template synthesis
 - self assembly
 - interactions-structure-property relations
 - smart nano-materials
 - nanocomposites
 - silk biomaterials

- *Polymers:*
 - role of chain defects and flow on polymer crystallization
 - bridging entangled polymer dynamics and melt processing
 - segmental motions in amorphous polymers

- *Suspensions and soft solids:*
 - flow visualization
 - non-linear rheology of soft solids



Looking ahead

- Contributing to the growth of polymer industry in India.
- Contributing to technology development in plastics via mission mode (PPP) programs.
- Contributing to major R&D programs catering to the National Agenda.
- Facilitate creation of new start-ups through innovations in soft materials and processes.
- Continue high quality research in complex fluids.
- Attract the best available talent.



Contact information

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