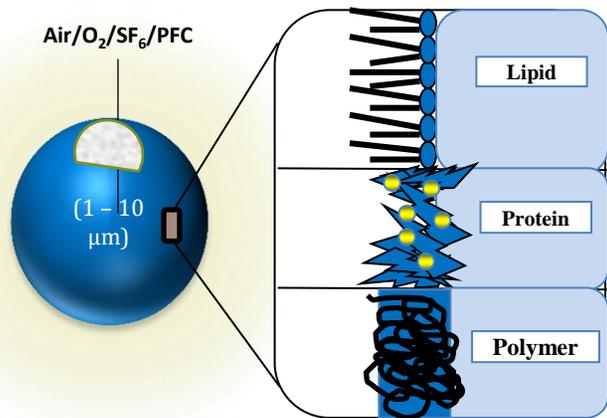


Engineering Microbubbles for Biomedical Applications

a GIAN short course



About Microbubbles

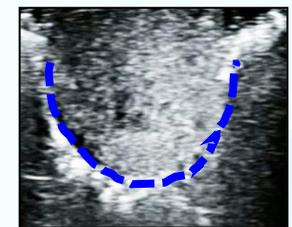
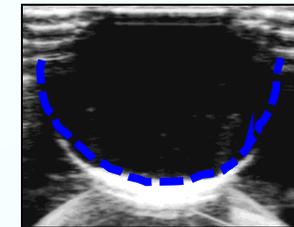
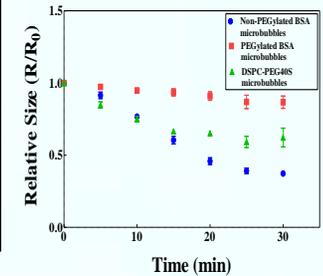
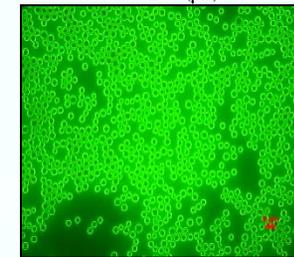
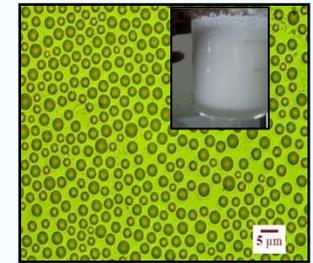
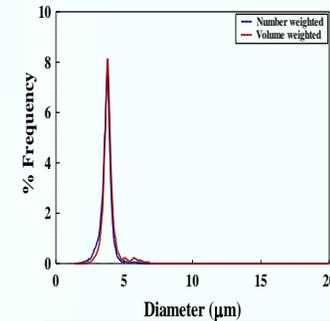
Microbubbles (MBs) are micron-sized, gaseous colloidal particles of 0.1-10 μm diameter in size, encapsulated in a stabilizing shell. The microbubbles are used for contrast-enhanced ultrasound (CEUS) imaging, drug and gene delivery, including across the blood-brain barrier (BBB), to dissolve clots and thrombus, and to oxygenate hypoxic tissue.

This course will mainly deal with design and engineering of microbubbles for biomedical applications, such as ultrasonic imaging and targeted drug delivery. Methods of microbubble synthesis, techniques for microbubble characterization, and issues related to microbubble stability and biocompatibility will be discussed. A few specific examples related to targeted drug delivery using microbubbles, such as targeting tumors and opening the BBB will also be discussed. In addition to lectures, practical sessions will be held for demonstrations of microbubble synthesis and characterization.

Objective

- Expose participants to the fundamentals of microbubble engineering for biomedical applications.
- Enhance understanding of the participants about the thermodynamics and kinetic processes involved in design and production of stable microbubble suspensions.
- To increase the awareness about the usefulness of microbubbles in important biomedical applications, such as ultrasound imaging and targeted drug delivery.

Microbubble Engineering @ IITGN



Who Should Attend

- Engineers and researchers from Pharmaceutical, Chemical Industries and R&D laboratories.
- Students at all levels (BTech/MSc/MTech/PhD) and Faculty from reputed academic institutions and technical institutions.

Dates : January 8-12
Venue : IIT Gandhinagar
Instructor : Prof. Mark A. Borden
 (Associate Professor,
 University of Colorado)

Schedule

Day 1

Lecture 1 : 1.5 hr: MAB

Introduction: Structure, characteristics, properties and applications of microbubbles; role of ultrasound.

Lecture 2: 1.5 hrs : MAB

Synthesis of Microbubbles: Various techniques; advantages and disadvantages of these techniques.

Practical 1: 2 hrs: MAB/SVD

Synthesis of microbubbles using the sonication method.

Day 2

Lecture 3 : 1.5 hrs: MAB

Producing narrow-sized microbubble suspensions: Techniques to produce a narrow size distribution.

Lecture 4: 1.5 hrs: MAB

Microfluidic devices: type, design, advantages and disadvantages.

Tutorial 2: 2 hrs: MAB/SVD

Characterization of microbubbles.

Day 3

Lecture 5 : 1.5 hrs: MAB

Stability of microbubble suspensions.

Lecture 6: 1.5 hrs: MAB

Thermodynamics and kinetics of microbubble dissolution.

Tutorial 3: 2 hrs: MAB/SVD

Demonstration of isolation of narrow-sized population

Day 4

Lecture 7 : 1.5 hrs: MAB

Engineering microbubbles for biomedical imaging:

Lecture 8: 1.5 hrs: MAB

Engineering microbubbles for targeted drug delivery:

Tutorial 4: 2 hrs: MAB/SVD

In-vitro dissolution studies:

Day 5

Lecture 9: 1.5 hrs: MAB

Biocompatibility of microbubbles

Lecture 10: 1.5 hrs: MVB

Nanodroplets: Thermodynamics and kinetics of phase-change agents and their applications

Tutorial 5: 2 hrs: MAB/SVD

Synthesis of drug-loaded microbubbles and in-vitro drug release.

Registration

Participants from outside India: \$500

Industry/ government lab: Rs. 5,000

Academic institutions:

Faculty: Rs. 2,000

Student: Rs. 1,000

Register online at:

http://www.iitgn.ac.in/gian/courses_microbubble.php

Accommodation is included in fees.

If you have difficulty in making this payment, please write to us.



Prof. Mark Borden is an Associate Professor of Mechanical Engineering, Fellow of Materials Science Engineering and Affiliate Member of Bioengineering at the University of Colorado

Boulder. He received a BS from the University of Arizona and PhD from the University of California Davis, both in chemical engineering. Borden's research interests are in the areas of interfacial phenomena and transport phenomena, with an emphasis on bubbles, emulsions and foams. He is a world-renowned expert in the field of microbubble engineering for biomedical applications. His lab has started two biotech companies. Borden's honors include the NSF CAREER Award and NYSTAR James D. Watson Investigator Award and invitation to the National Academy of Engineering Frontiers of Engineering symposium. He has published more than 80 journal articles in prestigious international journals, 11 patents and has contributed to more than 140 conference papers, presentations and posters.



Prof. Sameer V. Dalvi is an Associate Professor of Chemical Engineering, at IIT Gandhinagar. He has done his masters and PhD from IIT Bombay, both in Chemical Engineering. Dr Dalvi's research

interests are in the areas of colloidal suspensions and drug formulations, with key focus on the formulation of microbubbles as thernostic agents. He is recipient of NASI - Young Scientist Platinum Jubilee Award for the year 2015 by National Academy of Sciences, India, Young Engineers Award for the year 2010 by Institution of Engineers (India). He has published around 28 journal articles in international journals and has contributed to 26 conference papers, presentations and posters.