REPORT OF

NATIONAL WEBINAR ON

NANOMATERIALS FOR SUSTAINABLE APPLICATIONS

ORGANIZED BY

DEPARTMENT OF PHYSICS

& IQAC

ADARSH MAHAVIDYALAYA, OMERGA

ABSTRACT

Department of Physics & IQAC organized a National level webinar on "Nanomaterials for sustainable applications" on 17th February 2022. The Resource person for the webinar was **Dr. Sagar E. Shirsath, (Vivekanand College,Aurangabad,Visiting Fellow,UNSW, Sydney, Australia).**

Webinar on "Nanomaterials for sustainable applications"

(17th February 2022.)

Department of Physics & IQAC Successfully organized a webinar on "Nanomaterials for sustainable applications" on 17th February 2022.

The Resource person for the session was Dr. Sagar E.. Shirsath, a well-known Lecturer in Vivekanand College, Aurangabad.. It was a very informative webinar as Dr. Sagar E.. Shirsath enlightened the audience with a wide range of topics such as Macro ,Micro, Nano, Categories of Nanomaterial's, Properties of Nanomaterial's, Nanotechnologies not new, How to Make Nano Structure, Thin film by sputtering etc. The webinar began with a word of appreciation by the respected Principal, Prof. Dr. Dilip Garud Sir . The session saw an overwhelming response from PG, UG students of the department, Academicians, Professors, Research Scholars, Throughout india and abroad. A total of 118 participants including students and faculty, participated in the session.

Objective

Nanotechnology has important roles to play in international efforts in sustainability. We discuss how current and future capabilities in nanotechnology align with and support the United Nations' Sustainable Development Goals. We argue that, as a field, we can accelerate the progress toward these goals both directly through technological solutions and through our special interdisciplinary skills in communication and tackling difficult challenges. We discuss the roles of targeting solutions, technology translation, the circular economy, and a number of examples from national efforts around the world in reaching these goals. We have formed a network of leading nanocenters to address these challenges globally and seek to recruit others to join us.

The Resource Person

Dr. Sagar E. Shirsath (Short Biography)

- PhD in Physics from Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra in 2010
- Received prestigious **JSPS Post-doctoral fellowship from Japan Government.** Worked as a JSPS fellow at Department of Information Engineering, Shinshu University, Nagano, Japan (2012-2014)
- **Post-doctoral Research Fellow** in School of Materials Science and Engineering, University of New South Wales, Sydney, Australia (2017-2019)
- Currently working as a Lecturer in Department of Physics, Vivekanand College Aurangabad, MS, India (2006 – 2012, 2014 -2017, 2019 – Till dt.)
- **Currently a Visiting Fellow** in School of Materials Science and Engineering, University of New South Wales, Sydney, Australia (from 2019)

Research Areas:

- Oxide nano-materials and thin film, magnetic materials, ferroelectric and piezoelectric materials, interface engineering, composite materials, etc.

Editorial duties:

- Editor: Nano, IF: 1.56 (Publisher: World Scientific, Singapore)
- Editor: Nanomaterials, IF: 5.07 (Publisher: MDPI, Switzerland)
- Editor: Journal of Magnetism and Magnetic Materials, IF: 3.0 (Elsevier, Nederland)
- Editorial board member of 7 international peer reviewed journal, and reviewer of 72 international peer reviewed journals

Research Publications:

- Patents: 3-granted, 2 - filed
- Research paper: 275
- Book chapter: 7
- Book: 1

- Publications in International/National conference proceedings: **32,** including paper presentations at conferences held at USA, Japan, Australia, Taiwan, Singapore, Hong Kong, Brazil etc.

Key Research Indicator:

- **Total citations: >9000**
- **H-index: 60**
- **i10 index: 160**

Honours and Awards:

- 2020 **Listed in the ranking of scientist of top 2% by Stanford University, USA**
- 2017 Top 1% reviewer by Publons
- 2016– Science Writing Fellowship, University of New South Wales, Australia.
- 2015 – 'Outstanding contribution in reviewing' award by Elsevier publication group for 25 research journals
- 2012 – Japan Society for the Promotion of Science' (JSPS) post-doctoral fellowship award, JSPS, Japan.

S.R. NO	Faculty Name	Contribution
1	Dr. Garud D.P.	Principal
2	Prof. Ramshetti R.S.	Organizing secretory
3	Prof. Dindore U. B.	Co- Organizing secretory
4	Dr. Algude S.G.	Co- Organizing secretory
5	Prof. Mali S.B.	IQAC Coordinator
6	Dr. Mothe P.S.	Webinar Coordinator

Summary of the Webinar

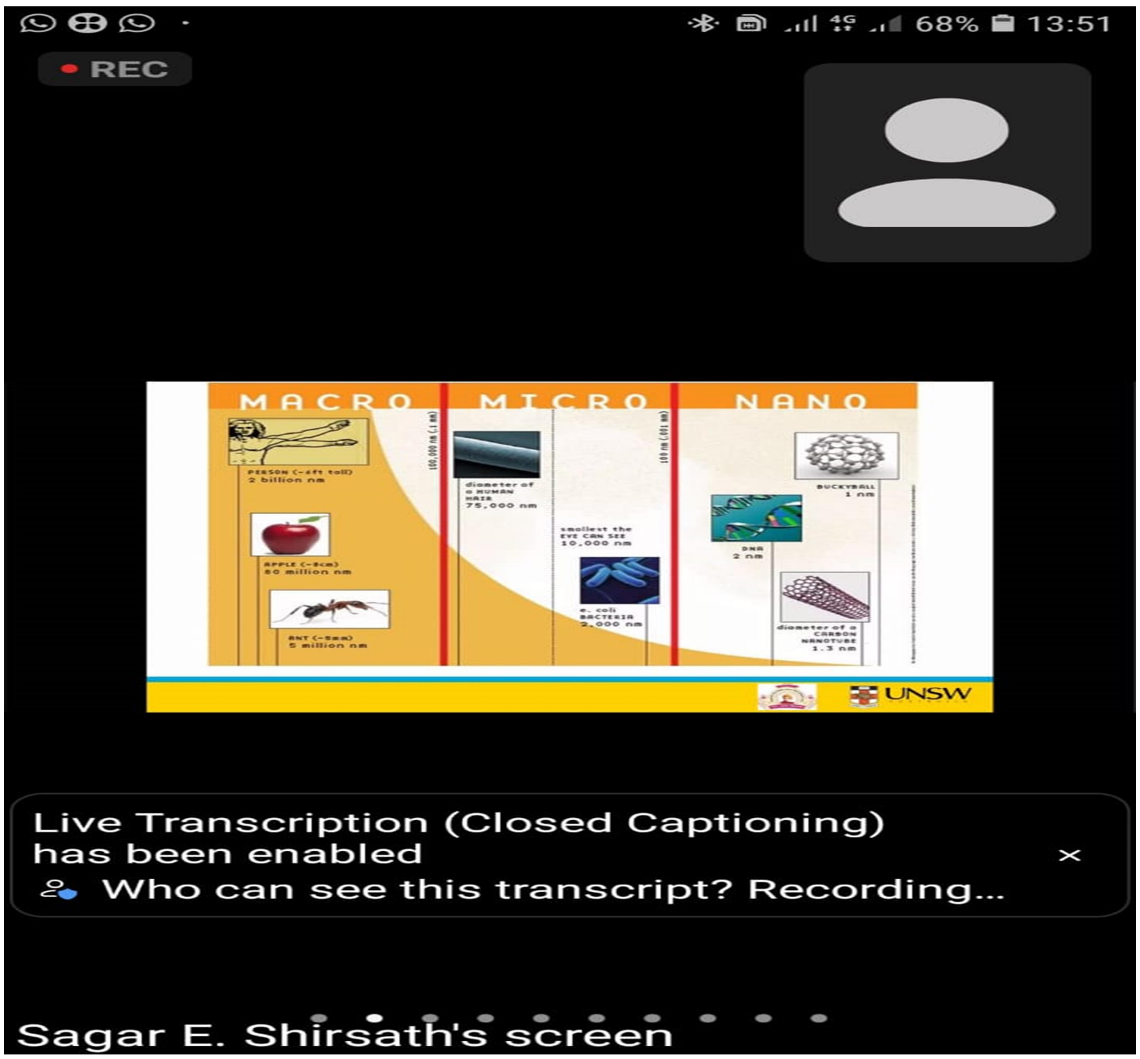
Dr. Sagar E. Shirsath started the session by providing an insight about some key statistics concerned with the Nanomaterials,its Applications, And Nanomaterials used in Electronic devices, Medicine, Farming, Industry Solar Cells etc , Burnham and Duggan were the pioneers to conceive the use of QDs for high efficiency solar cells in 1990. A large variety of solar cells have been developed over the past few decades. The high-performance solar cells of crystalline silicon and GaAs materials and the thin film solar cells made from CdTe and CIGS materials are constrained by the higher material and fabrication costs while Cadmium and telluride are rare and highly toxic metals.. On the other hand, dye-sensitized and organic solar cells have the advantage of higher flexibility and lower production cost. Schaller et. al, reported "spectroscopic evidence that several excitons could be efficiently generated upon absorption of a single energetic photon in a quantum dot, an approach now known as CM (carrier multiplication) or MEG (multiple exciton generation)"]. "This property boosts the energy conversion efficiency beyond the traditional Shockley and Queisser limit for silicon solar cells [24] through increased photocurrent. LANL's dots were made from PbSe." As per Hu et. al., "three types of solar cells have been reported in this category.

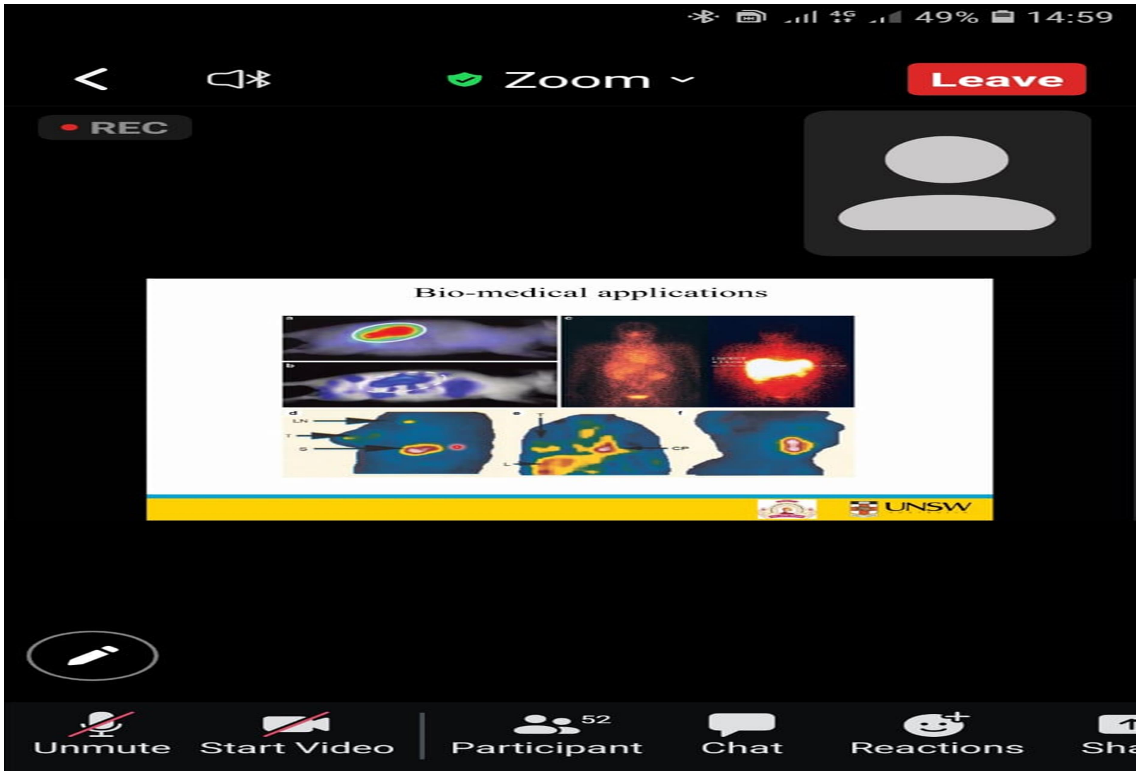
The key topics discussed by Resource person were as follows:

- The difference between Macro , Micro, Nano
- Categories of Nanomaterial's
- Why small is good?
- Nanomaterial's properties
- Gold Nanoparticles of various size and shape
- Nanotechnology is not new
- Faradays gold colloids
- Lycurgus cup
- How to make nanostructure
- Laser ablation
- Synthesis of mono dispersed nanoparticles
- Sol-gel method
- Thin film by Sputtring
- Characterization of nano materials

- Biomedical applications
- Nano robots
- Nanobots breaking kidney stones
- A mouthwash full of smart dental nanobots
- Nano-biomimicry

Glimpes of the webinar

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Bio-medical applications
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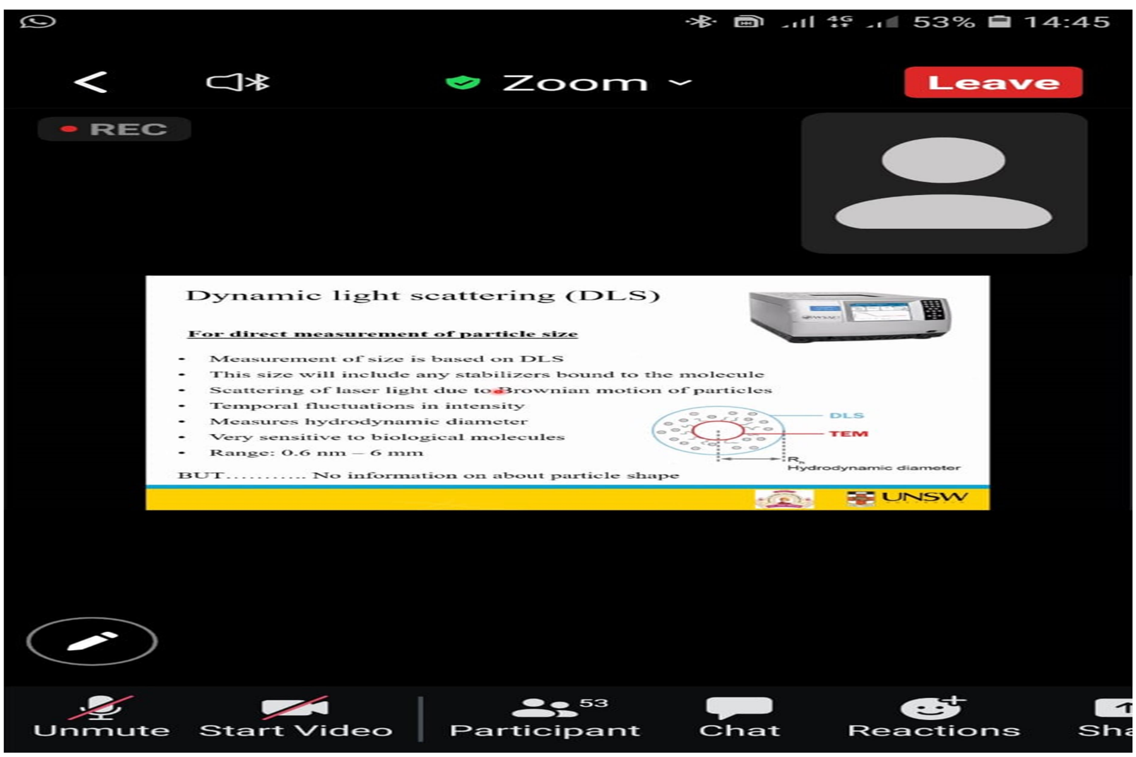
Chat
Reactions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Dynamic light scattering (DLS)
For direct measurement of particle size
• Measurement of size is based on DLS
• This size will include any stabilizers bound to the molecule
• Scattering of laser light due to Brownian motion of particles
• Temporal fluctuations in intensity
• Measures hydrodynamic diameter
• Very sensitive to biological molecules
• Range: 0.6 nm – 6 mm
BUT……….. No information on about particle shape
DLS
TEM
Hydrodynamic diameter
UNSW
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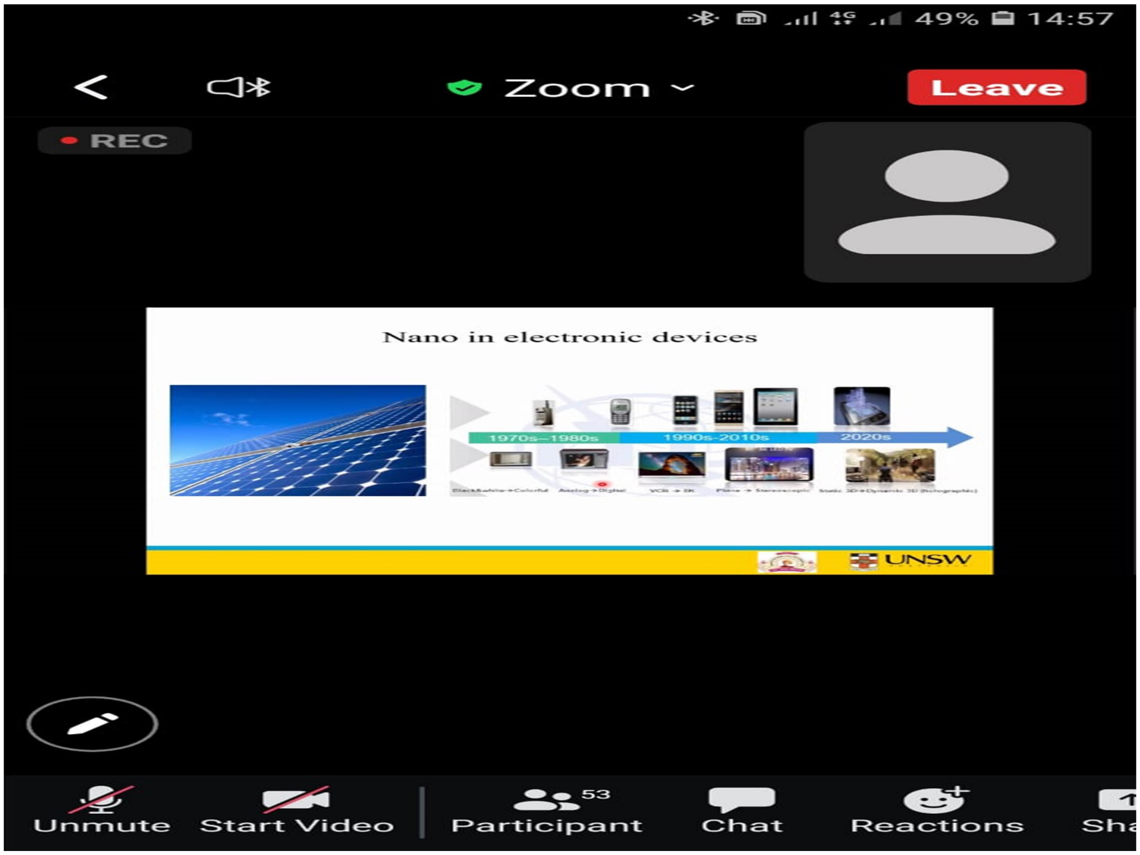
Participant
Chat
Reactions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Nano in electronic devices
1970s–1980s
1990s-2010s
2020s
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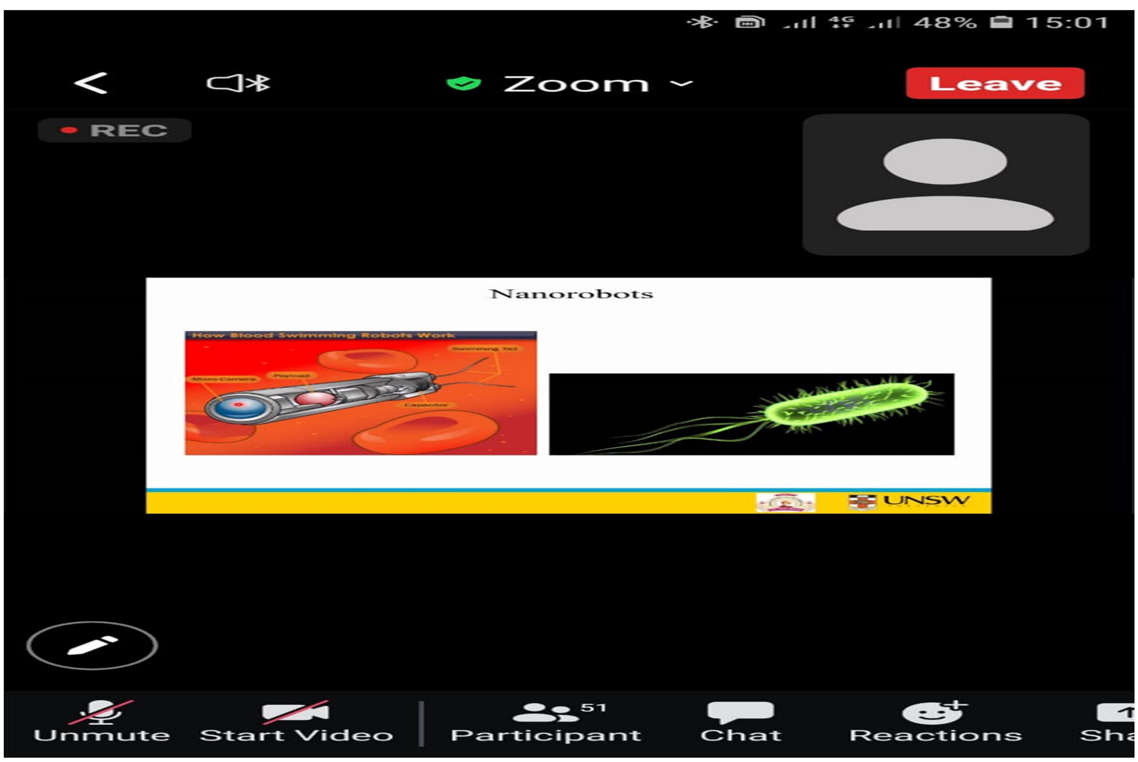
Reactions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Nanorobots
How Blood Swimming Robots Work
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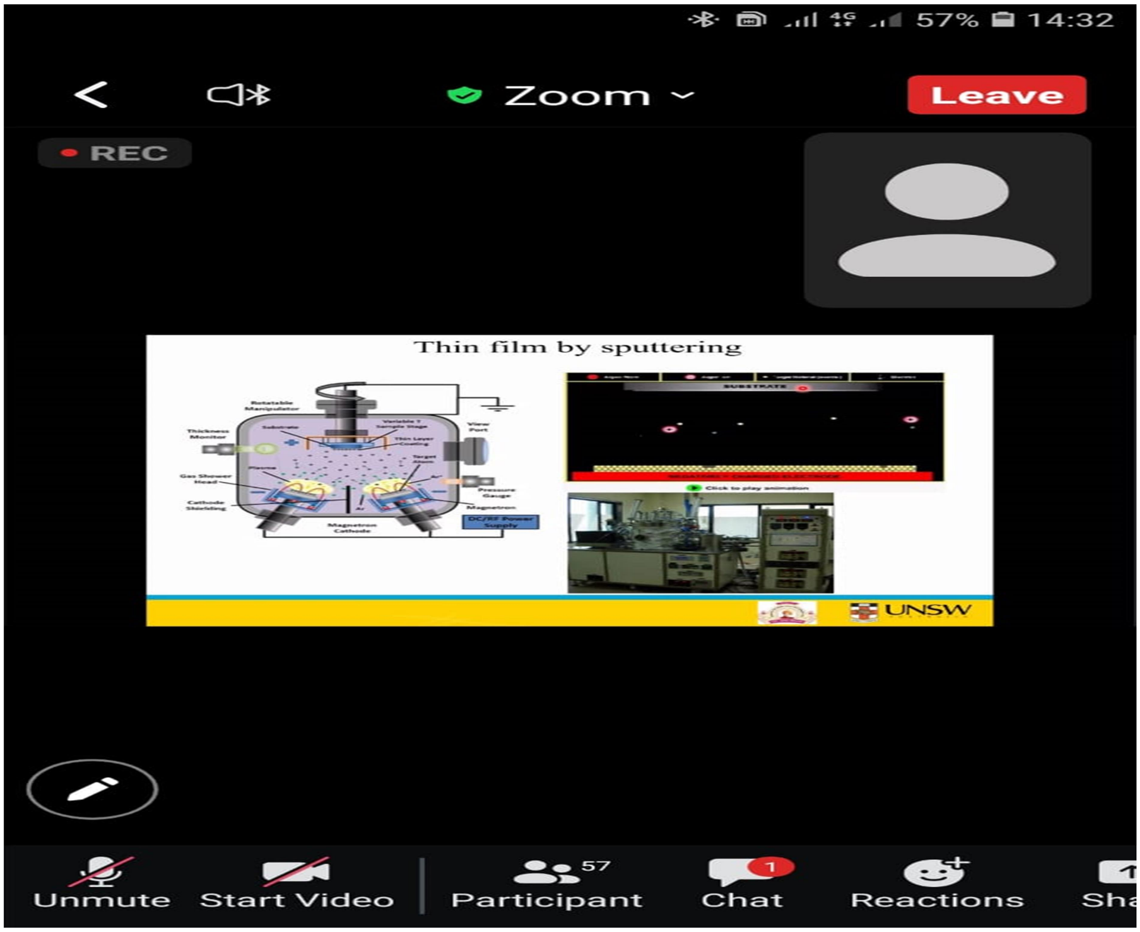
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Thin film by sputtering
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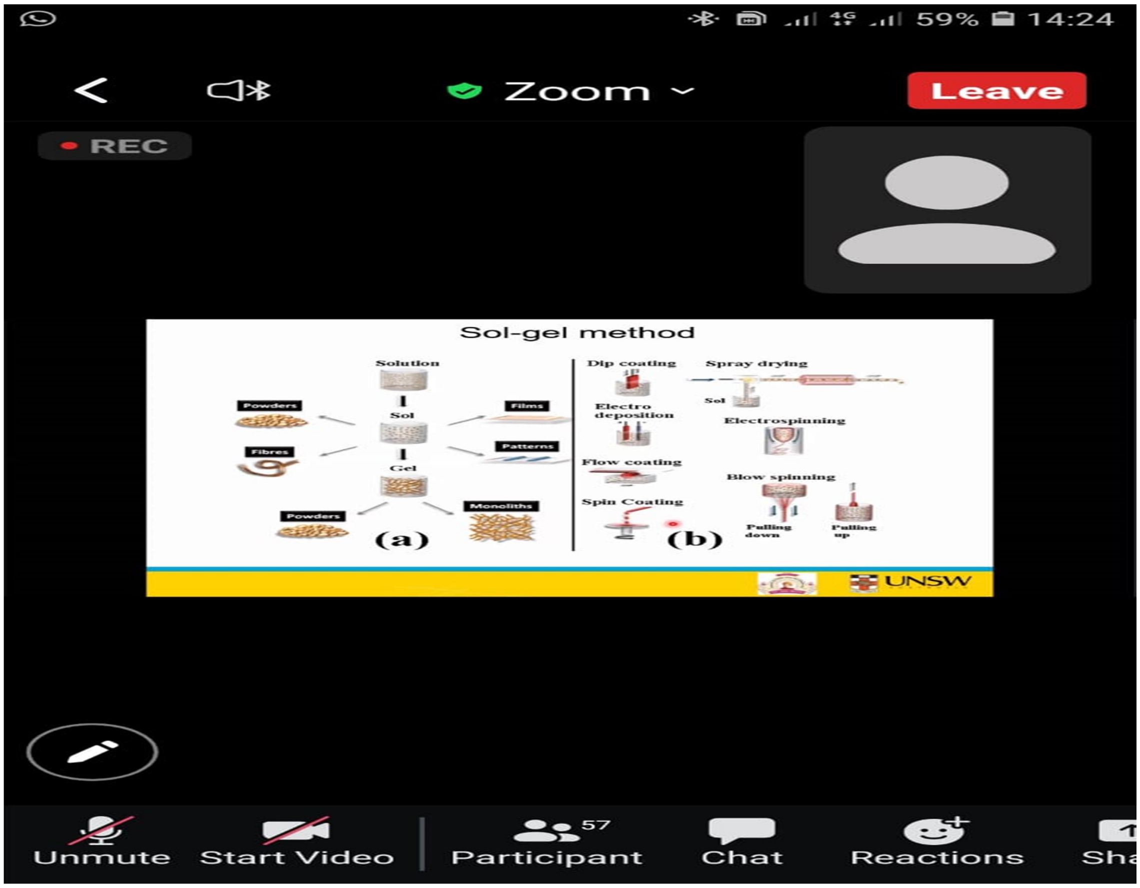
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Sol-gel method
Solution
Sol
Gel
Powders
Fibres
Films
Patterns
Powders
Monoliths
(a)
Dip coating
Spray drying
Sol
Electro deposition
Electrospinning
Flow coating
Blow spinning
Spin Coating
Pulling down
Pulling up
(b)
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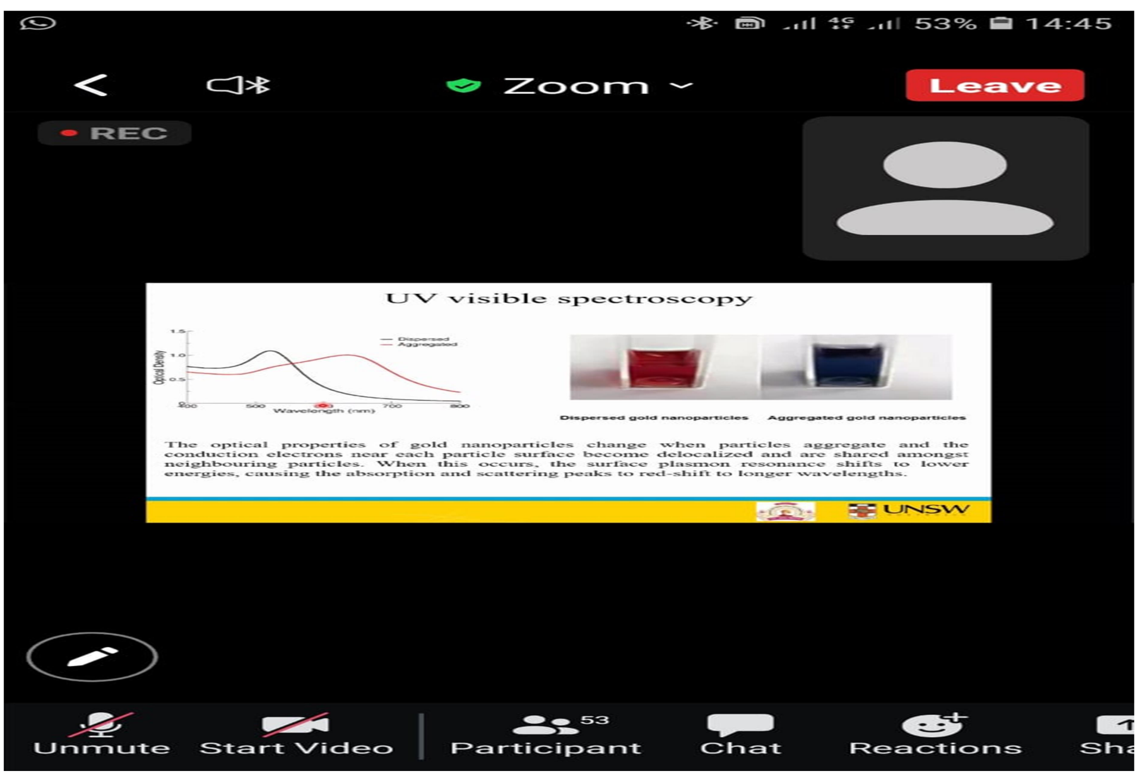
Reactions


53% 14:45
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UV visible spectroscopy
Dispersed
Aggregated
Optical Density
Wavelength (nm)
Dispersed gold nanoparticles
Aggregated gold nanoparticles
The optical properties of gold nanoparticles change when particles aggregate and the conduction electrons near each particle surface become delocalized and are shared amongst neighbouring particles. When this occurs, the surface plasmon resonance shifts to lower energies, causing the absorption and scattering peaks to red-shift to longer wavelengths.
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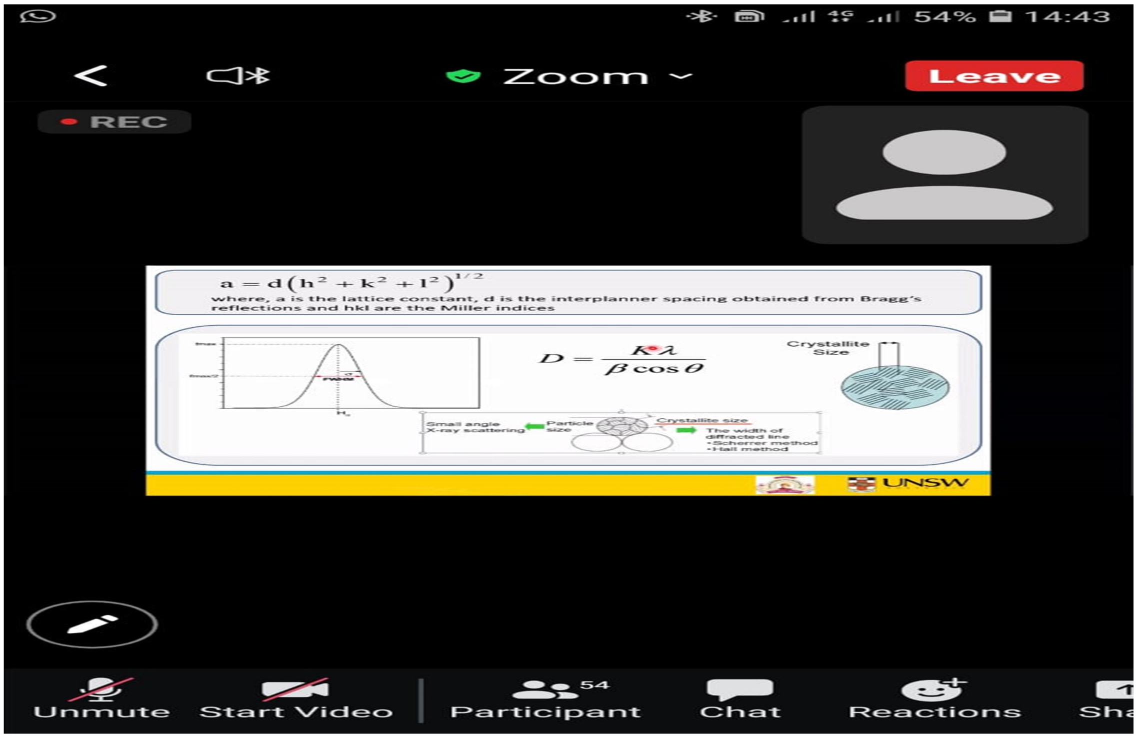
Reactions



14:43
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REC
$a = d(h^2 + k^2 + l^2)^{1/2}$
where, a is the lattice constant, d is the interplanner spacing obtained from Bragg's reflections and hkl are the Miller indices
$D = \frac{K\lambda}{\beta \cos\theta}$
Crystallite Size
UNSW
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Chat
Reactions

15:20
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Who can see this transcript? Recording...
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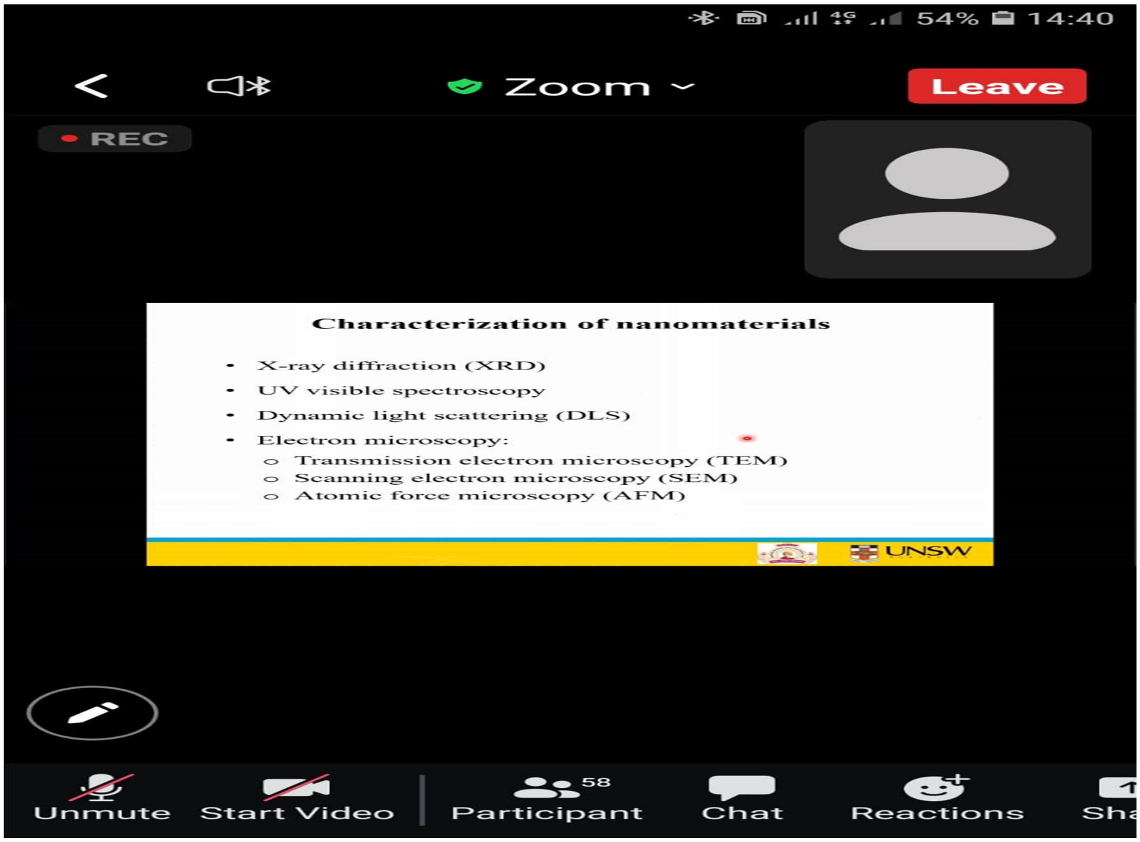
Reactions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Characterization of nanomaterials
X-ray diffraction (XRD)
UV visible spectroscopy
Dynamic light scattering (DLS)
Electron microscopy:
Transmission electron microscopy (TEM)
Scanning electron microscopy (SEM)
Atomic force microscopy (AFM)
UNSW
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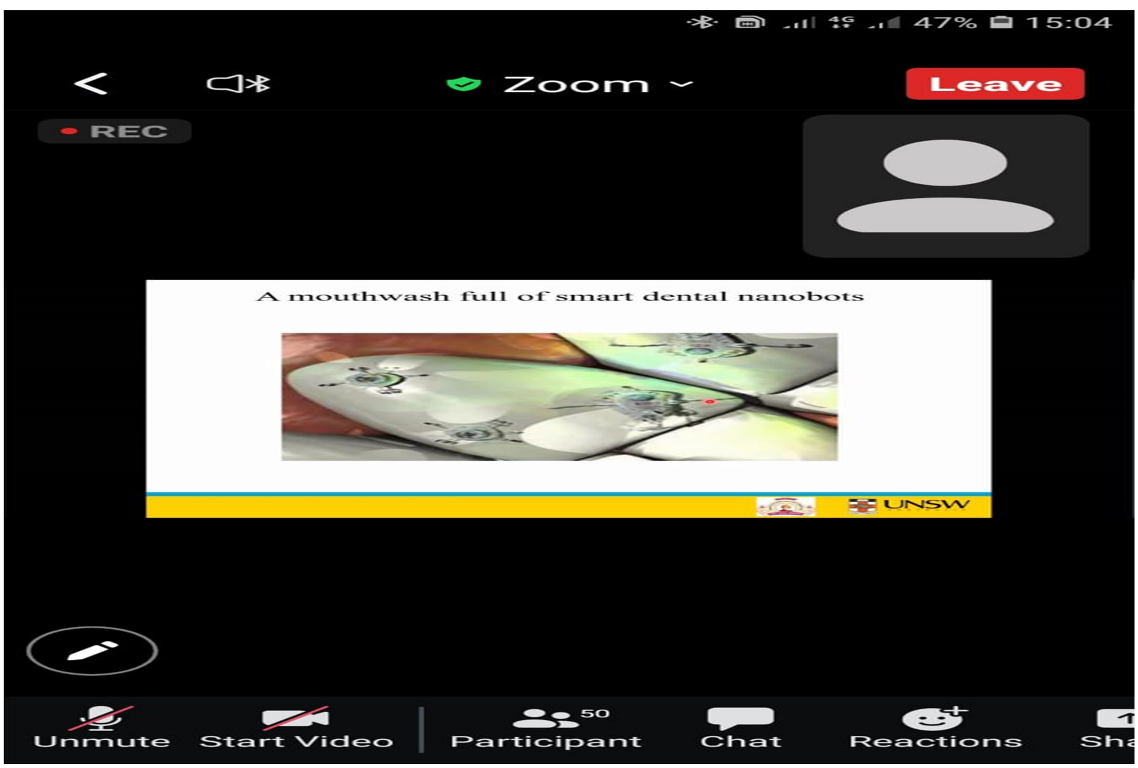
Reactions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A mouthwash full of smart dental nanobots
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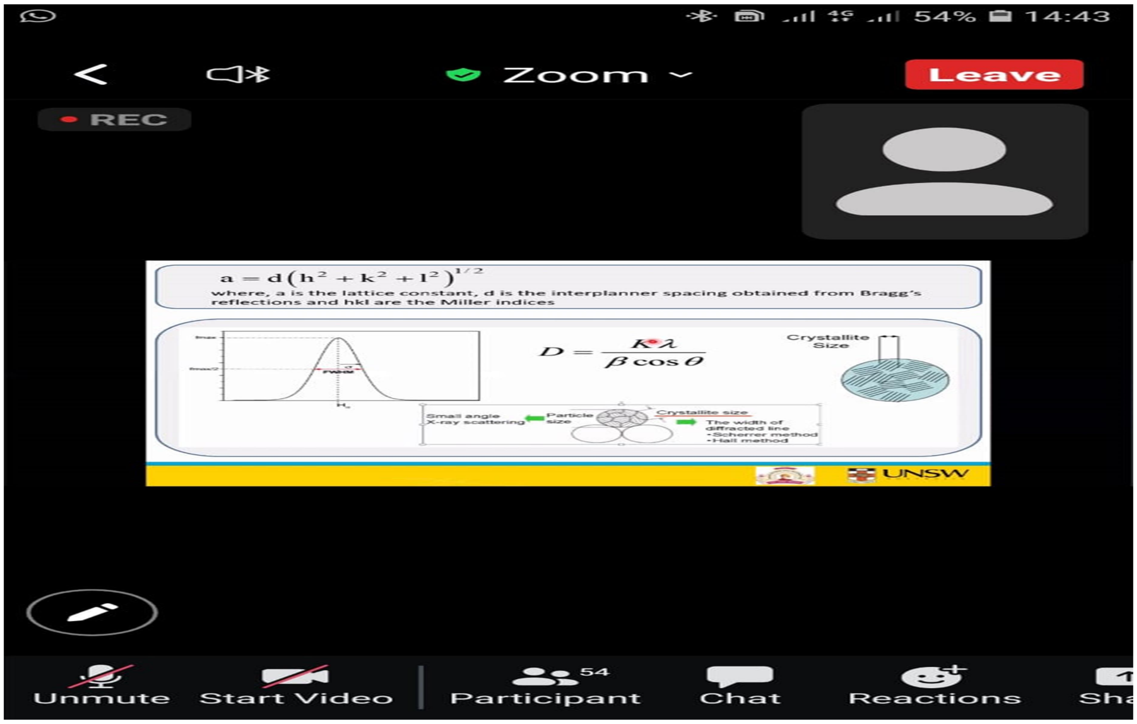
Participant
Chat
Reactions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a = d(h² + k² + l²)^1/2
where, a is the lattice constant, d is the interplanner spacing obtained from Bragg's reflections and hkl are the Miller indices
D = Kλ / β cos θ
Crystallite Size
FWHM
Small angle X-ray scattering
Particle size
Crystallite size
The width of diffracted line
•Scherrer method
•Hall method
UNSW
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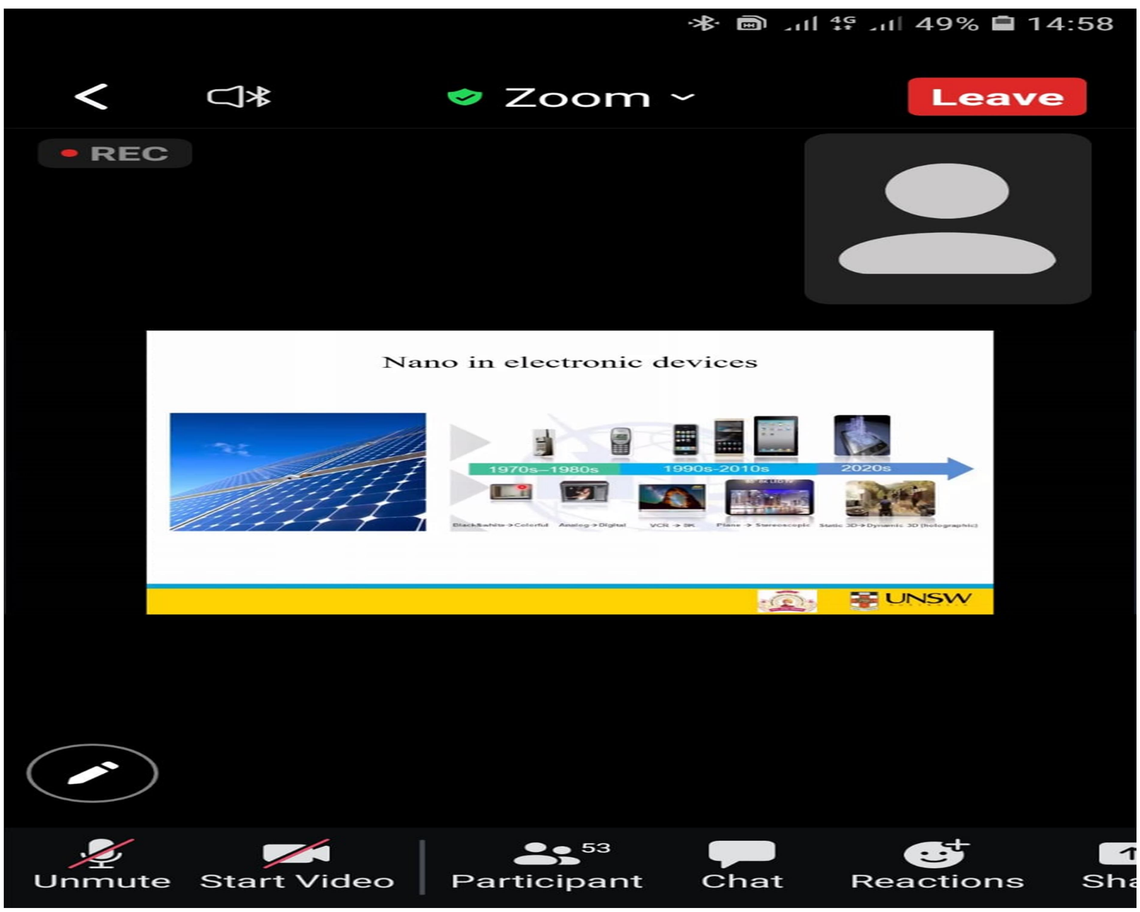
Participant
Chat
Reactions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Nano in electronic devices
1970s–1980s
1990s-2010s
2020s
UNSW
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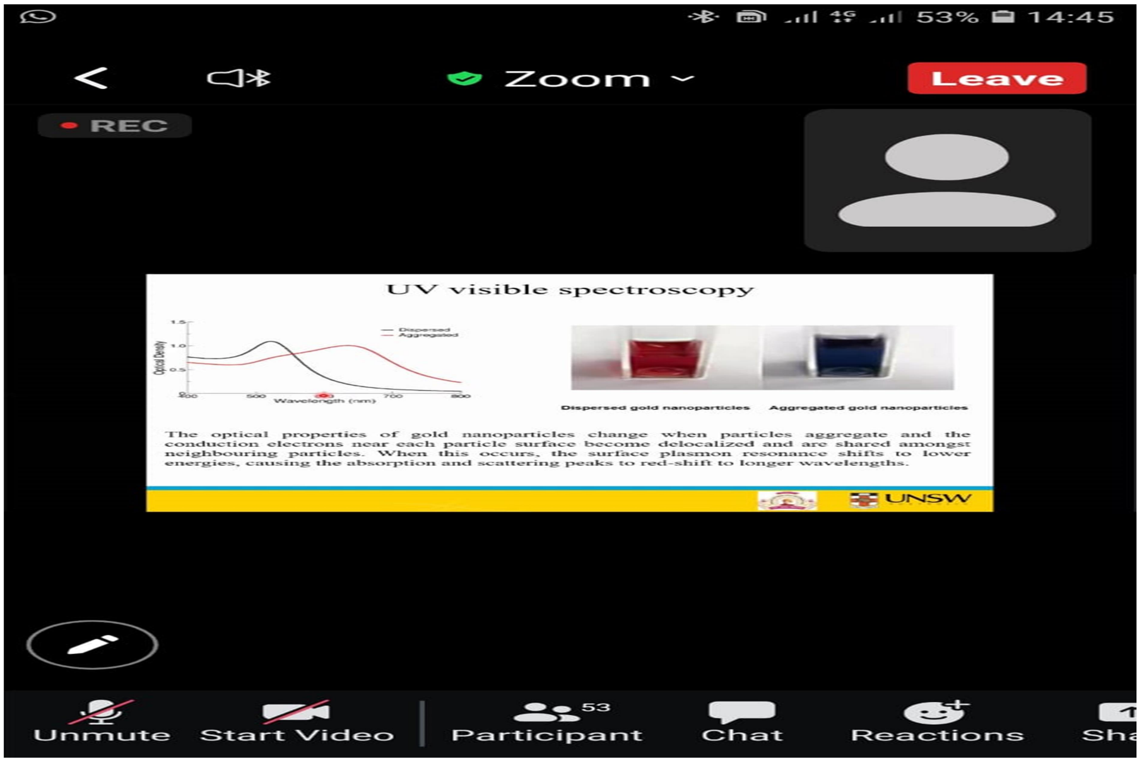
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UV visible spectroscopy
Dispersed
Aggregated
Optical Density
Wavelength (nm)
Dispersed gold nanoparticles
Aggregated gold nanoparticles
The optical properties of gold nanoparticles change when particles aggregate and the conduction electrons near each particle surface become delocalized and are shared amongst neighbouring particles. When this occurs, the surface plasmon resonance shifts to lower energies, causing the absorption and scattering peaks to red-shift to longer wavelengths.
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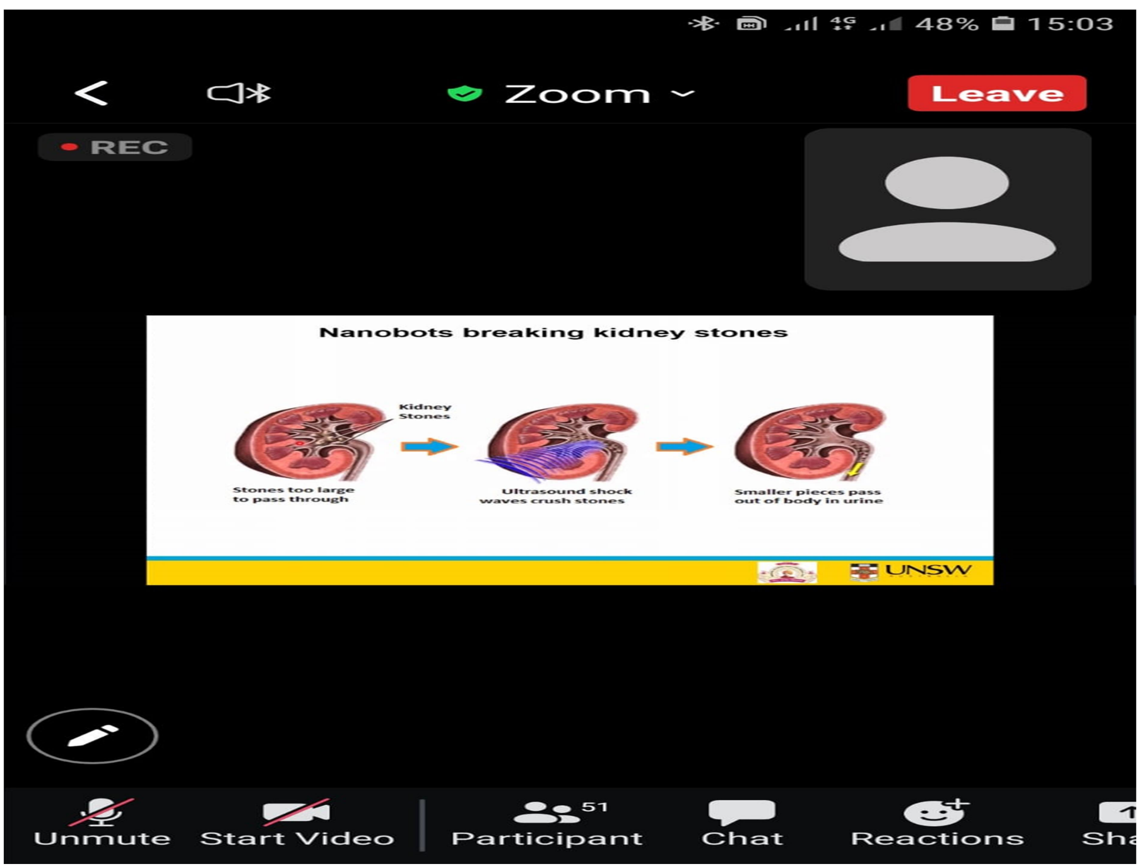
Reactions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Nanobots breaking kidney stones
Kidney Stones
Stones too large to pass through
Ultrasound shock waves crush stones
Smaller pieces pass out of body in urine
UNSW
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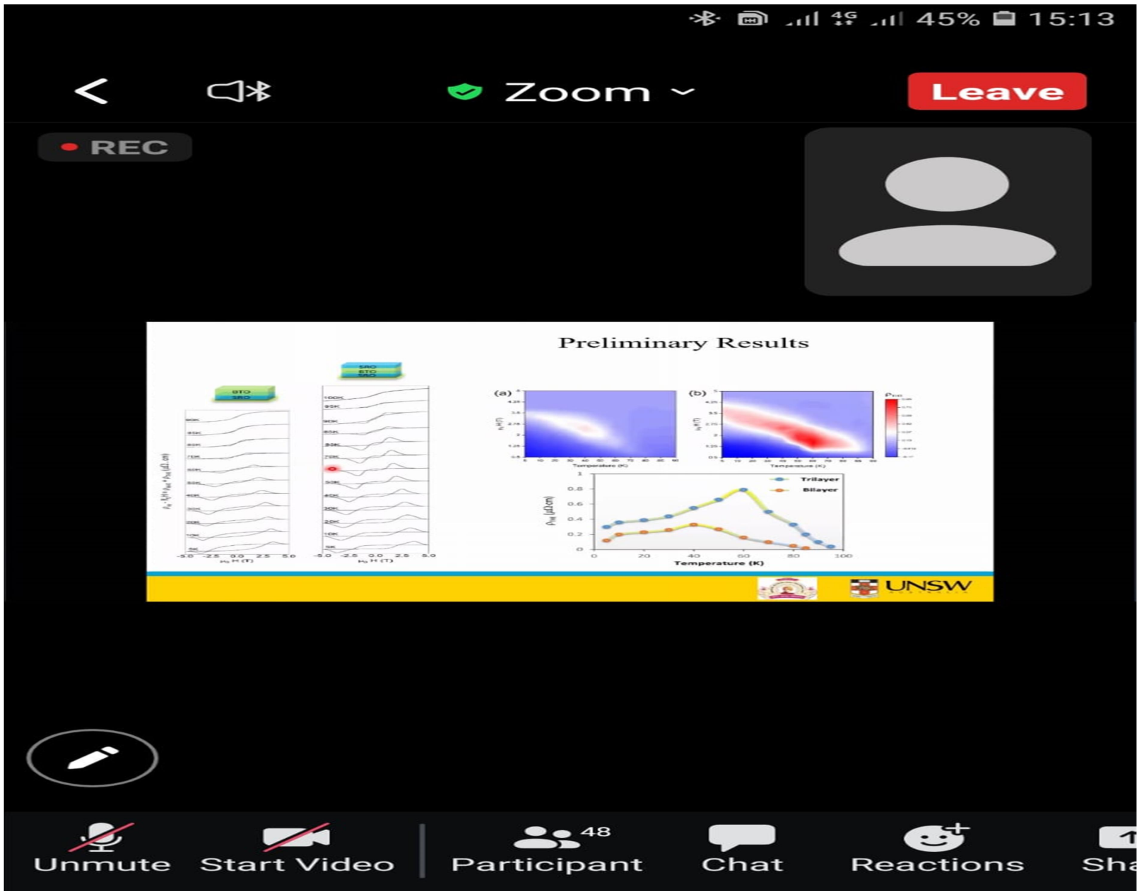
Start Video
51
Participant
Chat
Reactions


45% 15:13
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Preliminary Results
Trilayer
Bilayer
Temperature (K)
UNSW
Unmute
Start Video
48
Participant
Chat
Reactions

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