

# COGNITION

*Quarterly Research Newsletter of NIT Raipur*  
*VOLUME 2, ISSUE 3, OCTOBER 2022*



**NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR**

G.E. Road, Raipur – 492 010



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COGNITION

## Editorial Note : COGNITION Volume 2, Issue 3



Dear Reader,

Welcome to the Volume 2, Issue 3 of Cognition!

This Issue brings to you the steady and impressive progress that National Institute of Technology (NIT) Raipur has made in research, academics and related activities.

The third quarter of the year i.e., July 2022 – September 2022, had been immensely productive and Issue 2 (Volume 3) brings to you the related highlights. The Institute, during this short span of three months, could produce numerous research publications in various high impact factor journals. Our dedicated faculty and students also contributed to the store-house of knowledge by publishing chapters, books etc. with reputed publishers.

This Issue thus offers insight into some of these and also various research projects that have been approved or sanctioned in this quarter. It also shares details of the patents awarded; MoUs signed; conferences, seminars, STTPs organized; start-ups initiated and innovation executed. You will surely find this Issue informative and relevant.

We must share that the Institute's constant progress in research and academics is the result of the untiring efforts of our Honourable Director NIT Raipur, Dr. A.M. Rawani. It is because of his vision that the Institute is achieving extraordinary heights. We thank him with our heart and soul!

We are also grateful to our respected Deans, Heads of all the departments, faculty, researchers, scholars, administrative and non-teaching staff for all their support.

With this, we wish you a happy reading!

We would appreciate if you let us know your queries, inputs or concerns. We can be contacted at: [cognition@nitrr.ac.in](mailto:cognition@nitrr.ac.in).

Team Cognition wishes you a great year ahead!

Warm regards!

Editorial Team  
Cognition

**HEAD**



**Dr. Ayush Khare**  
Associate Professor  
Department of Physics

**MEMBER**



**Dr. A. K. Dash**  
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Department of ME

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**Dr. Moksha Singh**  
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Department of HSS

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**Dr. Deepak Singh**  
Assistant Professor  
Department of CSE

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## PUBLISHED BOOKS & BOOK CHAPTERS

**Title of book:** A Complete Guidebook on Biofilm Study

**Publisher:** Elsevier

**ISBN:** 9780323884808, **eBook ISBN:** 9780323884815

**Month and year of publication:** July 2022

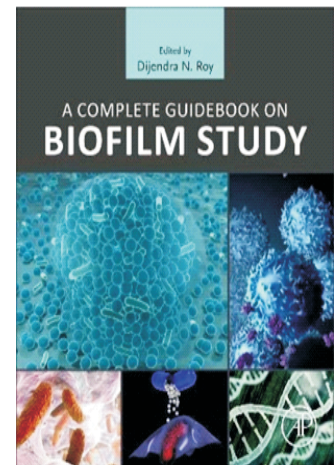
**Author :** Dr. D.N. Roy, Department of Biotechnology

**About the book:**

The 'A COMPLETE GUIDEBOOK ON BIOFILM STUDY' is all about the biofilm-oriented book. Various experimental designs for the bio film studies are highlighted in this book. The inhibitors from natural or synthetic sources against microbial biofilm are addressed, which is further substantiated by bioinformatics as well as nanotechnology-based efforts. The image processing related to biofilm and the properties of substratum for biofilm formation are also included. Further, how biofilm helps and/or hampers food processing and waste management system, that discussion is also considered in this book. Similarly, human benefits and disadvantages of biofilm are also reviewed by highlighting host-pathogen interaction.

**Purchase link:** <https://www.amazon.com/Complete-Guidebook-Biofilm-Study/dp/0323884806>

<https://www.sciencedirect.com/book/9780323884808/a-complete-guidebook-on-biofilm-study>



**Title of book chapter:** Feature Extraction and Fusion of Multiple Convolutional Neural Networks for Firearm Detection

**Book:** Advanced Machine Intelligence and Signal Processing

**Publisher:** Springer, Singapore

**ISBN of book:** 978-981-19-0840-8 (Online)

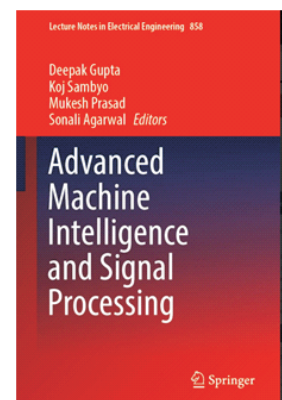
**Month and year of publication:** July 2022

**Authors' names:** Dr. Anamika Dhillon and Dr. Gyanendra K Verma, Department of IT

**About the book**

This work focuses on the classification and detection of guns which integrates deep fusion of feature information to generate the most discriminant feature vector. Firstly, we utilize the fully connected layers of recent deep CNN models: Inception-ResNetv2 and MobileNetv2 for feature extraction, and then we fuse these features by using concatenation operation. To acquire a more compact presentation of features and reduce the complexity of computation, we have utilized NCA. After that, we classify the images by using an SVM classifier. Finally, to detect the guns in an image, a bounding box regression module is proposed by applying LSTM. Qualitative and quantitative outcomes indicate that our framework can detect guns with huge variations in size along with rigorous occlusion.

**Purchase link:** [https://link.springer.com/chapter/10.1007/978-981-19-0840-8\\_34](https://link.springer.com/chapter/10.1007/978-981-19-0840-8_34)



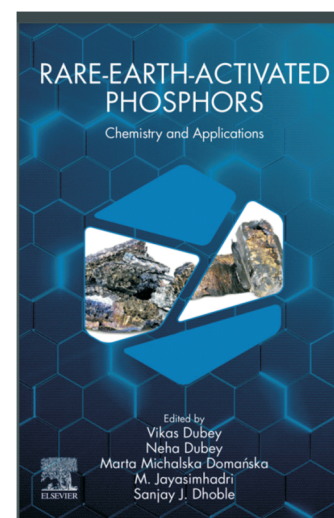
**Title of book chapter:** Rare Earth Activated Phosphors: Chemistry and Applications Spectroscopy Techniques for Rare-earth-activated Phosphors

**Publisher:** Elsevier

**ISBN:** 978-0-323-89856-0

**Month and year of publication:** July 2022

**Author :** Dr. Sadhana Agrawal, Department of Physics



### **About the book:**

Rare-earth-activated phosphors have attracted researchers because of their enhanced energy efficiency, color rendering index (CRI), lumen output, and greater radiation stability. In the trivalent rare-earth ions, the emissions take place due to 4f electrons that remain unperturbed in the host lattice. Because of this, rare-earth-activated phosphors have high luminescence intensity, greater quantum yield, high luminescence efficiency, high stability, etc. and hence resulting in their application in X-ray photography, phosphor thermometry, color TV picture tubes, fluorescent lamps, light-emitting diodes, etc. This chapter describes the various spectroscopic techniques to investigate some optical properties of rare earth activated phosphors.

**Purchase link:** <https://doi.org/10.1016/C2020-0-03103-8>

## **SPONSORED RESEARCH PROJECTS**

**Title of the project :** Development of Functionally Graded Nano Composite Foam for Armor Application

**Sponsoring agency :** SERB-DST, New Delhi

**Duration :** July 2022-June 2025

**Amount Sanctioned :** Rs. 23.32 Lakhs

**Principal Investigator (PI) :** Dr. Neha Gupta, Department of Metallurgical and Materials Engg.

**Co-PI :** NA

### **Project Summary**

Protection against new ballistic threats demand development of new armor systems with improved ballistic properties, especially light weight, multi-hit capability and large impact energy absorption. Use of cermets as  $B_4C$ ,  $Al_2O_3$ , SiC reinforced Al and Steel systems have been worldwide explored by various researchers in the field. However, the ballistic property achieved from cermet systems rarely matches with woven fabric and kevlar armor systems, specifically in terms of multi-hit capability and low weight. Cermet foams can help in achieving lower weight along with large energy absorption. Further, energy absorption can be increased by backing with Al<sub>6</sub>xxx structure.

This study involves developing an optimized: cermet composition, FGM thickness and process route to develop proposed armor system. This armor system will be lab tested for static and dynamic compression strength followed by Ballistic Field trials at DMRL/CSIR facilities. It is assumed that compared to traditional cermet/metal armors, this proposed armor structure will help in decreasing the issues related with generation of residual stresses, delamination at ceramic-metal interface, plastic deformation of metal plate and shattering of ceramic while achieving reduced weights and improved impact resistance; thereby developing improved armor system. Moreover, the proposed structure is environment friendly and involves easier processing with reduced cost.



**Title of the project :** Development of Redox Nanomaterials Based Point-of-Care Nanofibrous Device for Infectious Mucormycosis Black Fungus Rapid Detection and Capturing

**Sponsoring agency :** SERB-DST, New Delhi

**Duration :** September 2022-August 2024

**Amount Sanctioned :** 30 Lakhs

**Principal Investigator (PI) :** Dr. Chinmaya Mahapatra, Department of Biotechnology

**Co-PI :** NA

### **Project Summary**

This fungal infection occurs mostly in people whose immune systems are weakened or who are receiving corticosteroid therapy. Lipid formulation of amphotericin B (Am-B) is of high cost, needs special storage conditions, degradability issue, and low efficiency. The present antifungal nanoformulation has failed to lower the black fungus infection. Furthermore, the often need for a long duration of treatments, or the high frequency of use of these agents facilitates the emergence of immune resistance therefore the prevalence of mycotic infections is still increasing. Cerium oxide based redoxnanofibrous form gives the capacity to specifically target black fungus and capture it for further diagnosis. So the development of point-of-care nanofibrous device for infectious mucormycosis “Black Fungus” rapid detection and capturing is the need of the hour.

## **Memorandum of Understanding (MoU) Signed (July 2022-September 2022)**

**Name of Organization:** All India Institute of Medical Sciences, Raipur

**Date of MOU:** September 09, 2022

### **Purpose of MOU:**

For the advancement of healthcare science & engineering through collaborative research activities, educational programmes, joint events and exchange of faculty, scientific & technical information.

## PUBLISHED RESEARCH PAPERS (July-September 2022)

**Title:** Theoretical spectroscopic signature of synephrine using DFT and the effect of hydrogen removal

**Authors:** N. P. Yadav, A. K. Vishwkarma, K. Kumar, A. Vats, A. Pathak, R.Kumar, V. Mukerjee, S. Moharana, T. Yadav, C. Mahapatra, S.Srivastava

**Journal name:** Phase Transitions

**Volume/Issue/year:** Volume 95, Issue 7, 2022

**Web link:** <https://doi.org/10.1080/01411594.2022.2085101>

**SCI/ Scopus Indexed:** SCIE and Scopus

**Title:** Structural confirmation and spectroscopic signature of N-Allyl-2- hydroxy-5-methyl-3-oxo-2, 3-dihydrobenzofuran-2-carboxamide and its monohydrate cluster,

**Authors:** T. Yadav, A.K. Vishwkarma, G. Brahmachari, I. Karmakar, P. Yadav, S. Kumar, C. Mahapatra, J. Chowdhury, R. Kumar, G.N. Pandey, P.K. Tripathi, A. Pathak

**Journal name:** Journal of Molecular Structure

**Volume/Issue/year:** Volume 1267, 2022

**Web link:** <https://doi.org/10.1016/j.molstruc.2022.133566>

**SCI/ Scopus Indexed:** SCI and Scopus

**Title :** Angiogenic stimulation strategies in bone tissue regeneration

**Authors:** Chinmaya Mahapatra, Prasoon Kumar, Manash K. Paul, Awanish Kumar,

**Journal name:** Tissue and Cell

**Volume/Issue/year:** Volume 79, 2022

**Web link:** <https://doi.org/10.1016/j.tice.2022.101908>

**SCI/ Scopus Indexed:** SCI and Scopus

**Title :** Optimal Threshold Based-High Impedance Arc Fault Detection Approach for Renewable Penetrated Distribution System

**Authors:** Ch. D. Prasad, M. Biswal, M. Mishra, J. M. Guerrero and O. P. Malik

**Journal name:** IEEE Systems Journal

**Volume/Issue/year:** Early Access

**Web link:** DOI: 10.1109/JSYST.2022.3202809

**SCI/ Scopus Indexed:** SCI

**Title:** Intelligent Computing in Electrical Utility Industry 4.0: Concept, Key Technologies, Applications and Future Directions

**Authors:** Manohar Mishra; Monalisa Biswal; Ramesh C. Bansal; Janmenjoy Nayak; Ajith Abraham; Om P Malik

**Journal name:** IEEE Access

**Volume/Issue/year:** Early Access

**Web link:** DOI:10.1109/ACCESS.2022.3205031

**SCI/ Scopus Indexed:** SCI

**Title:** An Adaptive Push-Pull for Disseminating Dynamic Workload and Virtual Machine Live Migration in Cloud Computing

**Author:** K. Jairam Naik

**Journal name:** International Journal of Grid and High Performance Computing (IJGHPC)

**Volume/Issue/year:** 14(1), 1-25. 2022

**Web link:** <http://doi.org/10.4018/IJGHPC.301591>

**SCI/ Scopus Indexed:** ESCI & Scopus

**Title:** Patient-Centric Token-Based Healthcare Blockchain Implementation Using Secure Internet of Medical Things

**Authors:** Narendra K. Dewangan, Preeti Chandrakar

**Journal name:** IEEE Transactions on Computational Social Systems

**Volume/Issue/year:** Early Access

**Weblink:** <https://ieeexplore.ieee.org/document/9852192>

**DOI:-** 10.1109/TCSS.2022.3194872

**SCI/ Scopus Indexed:** SCIE

**Title:** Parametric analysis of thermoluminescent characteristics of rare earth activated ATiO<sub>3</sub>:Eu<sup>2+</sup>, Yb<sup>2+</sup>(A=Ca, Ba, Sr) phosphors

**Authors:** Shambhavi Katyayan and Sadhana Agrawal

**Journal name:** Optical and Quantum Electronics

**Volume/Issue/year:** August 2022

**Web link:**

**DOI:** 10.1007/s11082-022-04097-6

**SCI/ Scopus Indexed:** SCI

**Title:** Effect of cerium concentration on photoluminescence behaviour of Y<sub>6</sub>Ba<sub>4</sub>(SiO<sub>4</sub>)<sub>6</sub>F<sub>2</sub> phosphors

**Authors:** Pailendra Kumar Sahu and Sadhana Agrawal

**Journal name:** Optik

**Volume/Issue/year:** 269/2022

**Web link:** <https://doi.org/10.1016/j.ijleo.2022.169877>

**SCI/ Scopus Indexed:** SCI

**Title:** Evaluation of machine learning techniques with AVIRIS-NG dataset in the identification and mapping of minerals

**Authors:** Neelam Agrawal, Himanshu Govil, Snehamoy Chatterjee, Gaurav Mishra, Sudipta Mukherjee

**Journal:** Advances in Space Research

**Web:** <https://doi.org/10.1016/j.asr.2022.09.018>

**Title:** Implications and interrelations of litho-boundaries and vicinity of lineaments for hydrothermal alteration zones under remote sensing and GIS environment

**Authors:** Mahesh Kumar Tripathi, Himanshu Govil, Pralay Bhaumik

**Journal:** Advances in Space Research

**Web:** <https://doi.org/10.1016/j.asr.2022.05.019>

**Title:** Integrating patient symptoms, clinical readings, and radiologist feedback with computer-aided diagnosis system for detection of infectious pulmonary disease: a feasibility study

**Authors:** Tej Bahadur Chandra, Bikesh Kumar Singh & Deepak Jain

**Journal:** Medical & Biological Engineering & Computing

**Web:** 10.1007/s11517-022-02611-2

**Title:** Theoretical spectroscopic signature of synephrine using DFT and the effect of hydrogen removal

**Authors:** N. P. Yadav, A. K. Vishwkarma, K. Kumar, A. Vats, A. Pathak, R. Kumar, V. Mukerjee, S. Moharana, T. Yadav, C. Mahapatra, S. Srivastava

**Journal:** Phase Transitions

**Web:** <https://doi.org/10.1080/01411594.2022.2085101>

**Title:** Structural confirmation and spectroscopic signature of N-Allyl-2-hydroxy-5-methyl-3-oxo-2,3-dihydrobenzofuran-2-carboxamide and its monohydrate cluster

**Authors:** T. Yadav, A.K. Vishwkarma, G. Brahmachari, I. Karmakar, P. Yadav, S. Kumar, C. Mahapatra, J. Chowdhury, R. Kumar, G.N. Pandey, P.K. Tripathi, A. Pathak

**Journal:** Journal of Molecular Structure

**Web:** <https://doi.org/10.1016/j.molstruc.2022.133566>

**Title:** Angiogenic stimulation strategies in bone tissue regeneration

**Authors:** Chinmaya Mahapatra, Praseon Kumar, Manash K. Paul, Awanish Kumar,

**Journal:** Tissue and Cell

**Web:** <https://doi.org/10.1016/j.tice.2022.101908>

**Title:** Effect of Particle Size, Moisture Content and Density on the Hyperbolic Model Parameters for Non-cohesive Soil

**Authors:** Gaurav D Dhadse, Gangadhar Ramtekkar, Govardhan Bhatt

**Journal:** International Journal of Engineering

**Web:** 10.5829/IJE.2022.35.09C.04

**Title:** Integrating patient symptoms, clinical readings, and radiologist feedback with computer-aided diagnosis system for detection of infectious pulmonary disease: a feasibility study

**Authors:** Tej Bahadur Chandra, Bikesh Kumar Singh & Deepak Jain

**Journal:** Medical & Biological Engineering & Computing

**Web:** 10.1007/s11517-022-02611-2

**Title:** Patient-Centric Token-Based Healthcare Blockchain Implementation Using Secure Internet of Medical Things

**Authors:** Narendra K. Dewangan, Preeti Chandrakar

**Journal:** IEEE Transactions on Computational Social Systems

**Web:** 10.1109/TCSS.2022.3194872

**Title:** An Adaptive Push-Pull for Disseminating Dynamic Workload and Virtual Machine Live Migration in Cloud Computing

**Authors:** K. Jairam Naik

**Journal:** International Journal of Grid and High Performance Computing (IJGHPC)

**Web:** <http://doi.org/10.4018/IJGHPC.301591>

**Title:** Optimal Threshold Based-High Impedance Arc Fault Detection Approach for Renewable Penetrated Distribution System

**Authors:** Ch. D. Prasad, M. Biswal, M. Mishra, J. M. Guerrero and O. P. Malik

**Journal:** IEEE Systems Journal

**Web:** 10.1109/JSYST.2022.3202809

**Title:** A study of couple stress fluid past isotropic porous medium

**Authors:** Madasu Krishna Prasad, Priya Sarkar

**Journal:** Special Topics & Reviews in Porous Media: An International Journal

**Web:** 10.1615/SpecialTopicsRevPorousMedia.2022043960

**Title:** An analytical study of couple stress fluid through a sphere with an influence of the magnetic field

**Authors:** Madasu Krishna Prasad, Priya Sarkar

**Journal:** Journal of Applied Mathematics and Computational Mechanics

**Web:** 10.17512/jamcm.2022.3.08

**Title:** Intelligent Computing in Electrical Utility Industry 4.0: Concept, Key Technologies, Applications and Future Directions

**Authors:** Manohar Mishra; Monalisa Biswal; Ramesh C. Bansal; Janmenjoy Nayak; Ajith Abraham; Om P Malik

**Journal:** IEEE Access

**Web:** 10.1109/ACCESS.2022.3205031

**Title:** False positives reduction in pulmonary nodule detection using a connected component analysis-based approach

**Authors:** Satya Prakash Sahu, Narendra D Londhe, Shrish Verma, Priyanka Agrawal, Sumit K Banchhor

**Journal:** International Journal of Biomedical Engineering and Technology

**Web:** <https://doi.org/10.1504/IJBET.2022.124015>

**Title:** A LSTM-based approach for detection of high impedance faults in hybrid microgrid with immunity against weather intermittency and N-1 contingency

**Authors:** Awagan Goyal Ramesh Rao, Ebha Koley, Subhojit Ghosh

**Journal:** Renewable Energy

**Web:** <https://doi.org/10.1016/j.renene.2022.08.028>

**Title:** Design of a Double Cavity Nanotube Tunnel Field-Effect Transistor-based Biosensor

**Authors:** Anju Gedam, Bibhudendra Acharya, Guru Prasad Mishra

**Journal:** ECS Journal of Solid State Science and Technology

**Web:** <https://doi.org/10.1149/2162-8777/ac8835>

**Title:** Design and analysis of a double gate SiGe/Si tunnel FET with unique inner-gate engineering

**Authors:** Sidhartha Dash, Guru Prasad Mishra

**Journal:** Semiconductor Science and Technology

**Web:** <https://doi.org/10.1088/1361-6641/ac86ed>

**Title:** Design of Core Gate Silicon Nanotube RADFET with Improved Sensitivity

**Authors:** Chitikina Neeraj Venkatesh, Guru Prasad Mishra, Biswajit Jena

**Journal:** ECS Journal of Solid State Science and Technology

**Web:** <https://doi.org/10.1149/2162-8777/ac8313>

**Title:** Analysis of total ionizing dose response of optimized fin geometry workfunction modulated SOI-FinFET

**Authors:** Abhishek Ray, Alok Naugarhiya, Guru Prasad Mishra

**Journal:** Microelectronics Reliability

**Web:** <https://doi.org/10.1016/j.microrel.2022.114549>

**Title:** Design, synthesis and magneto-structural analysis of Cu(II)-coordination networks sustained by Nsingle bondH...O and O single bondH...O hydrogen bond

**Authors:** Archana Yadava, Bieńko, D.C. Bieńkoc, D. Wojtala, Kafeel Ahmad Siddiqui

**Journal:** Polyhedron

**Web:** <https://doi.org/10.1016/j.poly.2022.115892>

**Title:** Parametric analysis of thermoluminescent characteristics of rare earth activated ATiO<sub>3</sub>:Eu<sup>2+</sup>, Yb<sup>2+</sup>(A=Ca, Ba, Sr) phosphors

**Authors:** Shambhavi Katyayan and Sadhana Agrawal

**Journal:** Optical and Quantum Electronics

**Web:** [10.1007/s11082-022-04097-6](https://doi.org/10.1007/s11082-022-04097-6)

**Title:** Effect of cerium concentration on photoluminescence behaviour of Y<sub>6</sub>Ba<sub>4</sub>(SiO<sub>4</sub>)<sub>6</sub>F<sub>2</sub> phosphors

**Authors:** Pailendra Kumar Sahu and Sadhana Agrawal

**Journal:** Optik

**Web:** <https://doi.org/10.1016/j.ijleo.2022.169877>

**Title:** Perovskite Solar Cells: A Review of the Recent Advances

**Authors:** Priyanka Roy, Aritra Ghosh, Fresher Barclay, Ayush Khare and Erdem Cuce

**Journal:** Coatings

**Web:** <https://www.mdpi.com/2079-6412/12/1089>

## CONFERENCES / STTPs / FDPs Organized (July 2022-September 2022)

**Title of event:** International Conference on Emerging Application of Nanobiotechnology (ICEAN-2022)

**Duration:** September 26–27, 2022

**Organizing department:** Department of Biotechnology

**Organizing Secretaries:** Dr. Awanish Kumar, Dr. Sharda Bharti and Dr. Chinmaya Mahapatra

**Chairperson:** Dr. Lata S. B. Upadhyay

**Course Fee:** For Industrialists: Rs. 2000, For Faculty members: Rs.1500, For Students / Research Scholars: Rs. 1000 Plus GST @ 18%

### **Brief information about the event:**

An International Conference on Emerging Application of Nanobiotechnology (ICEAN-2022) was held at NIT, Raipur during 26–27 September, 2022. The objective of the conference was to provide young researchers and students with a comprehensive understanding of fundamental issues and application of Nanobiotechnology with high intensity. The topics included Medical nanotechnology, Environmental Nanotechnology, Cancer Biology, Drug discovery, Environmental Microbiology, Biosensors, Bioremediation, Agricultural Nanomedicines, Disease diagnosis, and Tissue Engineering.





**Title of event:** Faculty Development Program on Blockchain in Smart City: Emerging Technologies for the Next Decade and Beyond

**Duration :** September 19-30, 2022

**Organizing departments:** Department of IT and Department of CSE

**Organizing Secretaries:** Dr. Sudhakar Pandey and Dr. Preeti Chandrakar

**Chairmen:** Dr. Rakesh Tripathi and Dr. D. S. Sisodia

**Course Fee:** No registration fee

### **Brief information about the event:**

Blockchain is a unique technology and a fundamental concept of computer science. Moreover, Blockchain has proven itself to be instrumental for many applications, ranging from financial to governmental services. In many ways, this transformed applications and development to rethinking how information is distributed and processed over its infrastructure. While the majority of these applications are in the financial domain, key opportunities lie in connecting infrastructural services, such as Cloud, Fog, and Edge computing with blockchain to create and provide new applications and services. As in smart cities, users are more aware of the smart technologies including IoT and cloud technology. A decentralized storage system is required to maintain transparency and trust between the service providers and consumers in the smart cities. The following is a list of some of the many applications that were discussed in this workshop for the smart-cities. The following is a list of some of the agendas of the FDP: Applications in metered services, Applications with smart vehicles and transportations, Security Privacy and transparency issues in these services. With the above important aspects, AICTE Training and Learning (ATAL) Academy sponsored FDP was conducted to disseminate the cyber security risks in smart cities, enlisting the possible solutions for the same.



**Title of event:** National Level Seminar on “Rights of Women with Disabilities: Challenges and Opportunities”

**Duration:** September 17-18, 2022

**Sponsored by :** National Commission for Women (NCW), New Delhi

**Organizing departments:** Department of Humanities and Social Sciences and Department of IT

**Organizing Secretaries:** Dr. Moksha Singh and Dr. Mridu Sahu

**Chairmen:** Dr. U. K. Dewangan and Dr. Rakesh Tripathi

**Brief information about the event:**

Promoting women's rights is crucial for an inclusive socio-economic development in any society. The case becomes even stronger for women with physical and mental disabilities as they undergo discrimination that is compounded and creates systems that throw challenges with respect to 1) the private spheres (existence within the family and society), 2) the public sphere (education, employment, utilization of government programmes and policies, infrastructural facilities etc). Measures have been taken across the globe for sensitizing communities and bringing forth their concerns. The United Nations in its Millennium Development goals for instance insists on 'promoting gender equality and empowerment of women' and emphasises on focussing on women with disabilities. India too has taken strong measures in this direction. Various Constitutional provisions, legislations, government bodies such as the National Commission for Women (NCW) have devised effective programmes and policies that address the issues faced by women with disability. However, much work is still needed as these efforts experience major roadblocks due to lack of awareness of the rights of the women with disability, poor community sensitivity and inadequate implementation of measures initiated by the major stakeholders and organizations involved. Based on this premise, the seminar focused on the following objectives:

- To determine the intrinsic and extrinsic rights of the women with disabilities.
- To analyse the existing government policies and programmes for women with disabilities.
- To identify the factors social, cultural and economic that act as a hinderance in the adequate implementation of the programmes and policies introduced by the government.
- To determine the opportunities for reform that can promote inclusion of women with disabilities.



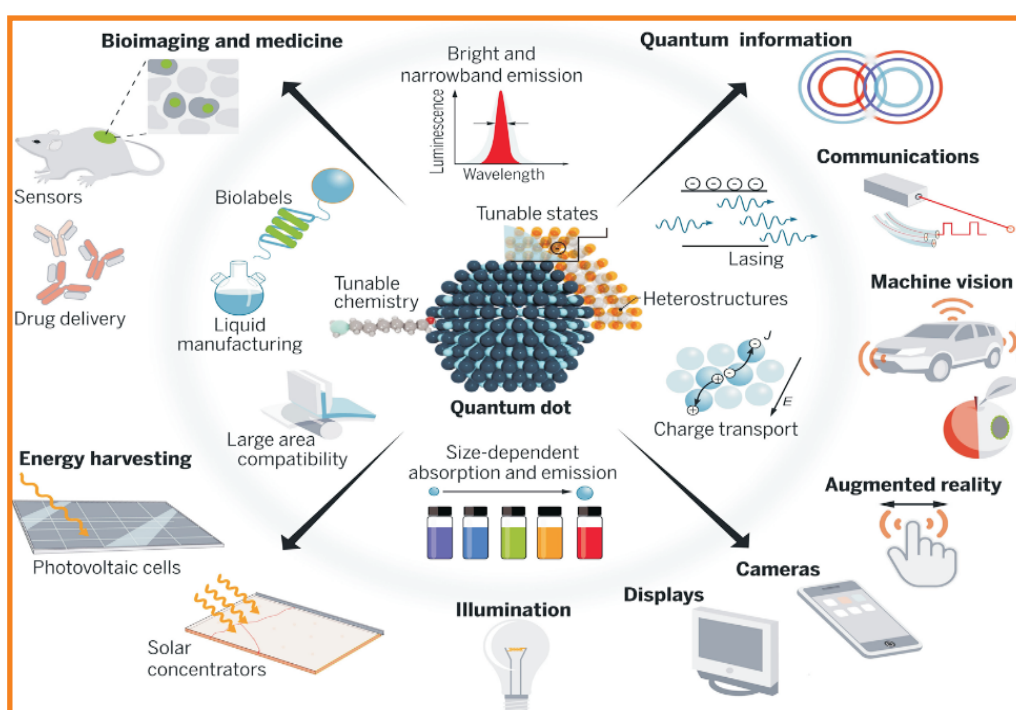
# ARTICLES OF PRIME RELEVANCE

## Core @ Shell Quantum Dots and their Applications

K. S. Ojha

Department of Physics, NIT Raipur

Quantum dots are point like artificial materials having size less than Bohr radius. It has unique optical and electronic properties that differ from other nano particles. QDs were first discovered by Alexey Ekimov in a glass matrix in 1980 and by R. Rossetti & Louis Brus in colloidal solution in 1985. The optical properties like band gap of QDs can be tune according to their size. As size of QDs decreases, a colour shift occurs from red to blue and consequently such materials has promising applications. But generally quantum dots are very unstable and to overcome these, the core @ shell quantum dots is designed. It is a type of biphasic materials which have an inner core structure and an outer shell comprises of different materials and its basic structure is like an onion. In the recent years, the synthesis of such core @ shell quantum dots impelled significant progress. By growing an epitaxial shell, the basic optical properties such as fluorescence quantum yield, emission wavelength and carrier lifetime can be tuned and due to these unique properties, core @ shell QDs have found vast applications in the field of scientific and commercial applications. Most of them recently been realized such as flexible devices, photo-detectors, solar cells, wastewater treatment, quantum computers, biomedical applications and Li-Fi. The core and the shell are typically composed of type II–VI, IV–VI and III–V semiconductors.



## **Study on the Hardened Properties of Concrete with Steel Slag as Coarse and Fine Aggregate**

**Meena Murmu, Nikhil Bapure and Nihar Ranjan Mohanta**

**Department of Civil Engineering, NIT Raipur**

### **Abstract**

In this study steel slag aggregate is used to make slag aggregate concrete. Waste slag aggregates are mostly obtained from the iron and steel industries as by-products. These wastes are generally disposed of in land fills, while emerging alternate disposal methods are being investigated. Further more, the increased rate of construction has resulted in a decrease in natural raw materials. Incorporating steel slag as a replacement for 20mm natural coarse aggregate to prepare concrete mixes for various volumetric replacements of 30%, 40%, and 50%, and incorporating fine slag aggregate as a replacement for natural fine aggregate to prepare fine slag aggregate concrete for various volume replacements of 30%, 40%, and 50%. Cube samples having different percentage of were casted to undergo the experimental analysis.

**Keywords:** Steel slag, Compressive strength, Natural aggregates Alternative coarse aggregates, XRD.

### **1. Introduction**

Normally, 65 to 85% of the volume of concrete is made up of aggregate. It is significant that aggregate type and quality have a major influence on the characteristics of concrete [1]. It is well known that aggregate is a material that has no chemical or physical qualities that can affect how concrete behaves. Aggregate is often a cheap material, and natural coarse and fine aggregates were widely used. Unfortunately, in some regions of the world, natural aggregate may no longer be able to satisfy the needs of building in terms of quality, quantity, or both.

These shortages present opportunities to locate substitute resources, such as wastes and by products [2,3]. Recycling these materials as aggregate not only addresses the issue of a lack of natural aggregate but also reduces pollution, disposal, and landfill use [5].

In today's world, a country's economic progress is mostly dependent on the development of infrastructure and industries. Concrete is considered an essential building element for the construction of major facilities [6]. Concrete is the second most consumed substance after water and is one of the most extensively utilized construction materials on the planet.

Because of the rapid growth of infrastructure around the world, the construction rate has accelerated. As a result, the utilization of natural raw materials in construction has increased. Alternative materials are being studied because these basic minerals are in short supply [7]. As a result, different materials with similar or better behavior are being employed to create concrete in place of aggregates or cement. On the other hand, due to the high-end use of various metals, the waste production of blast furnace slag from steel and iron industries has increased [8].

The most prevalent kind of industrial waste is steel slag (SS). The global production of steel slag ranged from 150 to 230 million tonnes in 2012, 190 to 290 million tonnes in 2018, and 230 to 350 million tonnes in 2021. SS is produced in either an electric arc furnace (EAF), of which steel is produced by melting scrap steel, or a basic oxygen furnace (BOF), of which iron is converted to steel. SS is created when the molten steel is separated from the impurities in the steel-making furnace [9]. Depending on the method used for producing the steel and its composition, one ton of steel typically yields 130 to 200 kg of SS. The big unused fraction filled up a lot of space on fields and harmed the environment as it was dumped near steel manufacturing facilities [10]. These wastes are taking up valuable area and posing a serious threat to the ecosystem. As a result, slag aggregates are frequently utilized to substitute coarse aggregates.

The use of steel slag as an aggregate replacement in concrete has been the subject of extensive research. Each year, China (Guo et al., 2018), US (National Minerals Information Center, 2019), and India (Indian minerals yearbook, May 2016) generates around 100, 16, and 12 million tons of steel slag, respectively. Slag wastes can also be employed in barrier-layer construction, roadway construction, cement manufacture, landfill cover, hydraulic barrier, and other applications, according to a few studies [2,10].

Table 1 Utilization rate of steel slag in different country [Dong et al. 2021]

Country	Rate of Utilization	Road construction	Civil engineering	Cement production	Agriculture	Disposal
Japan	98.4%	32%	31%	3.4%	3.1%	1.6%
US	85%	60%	16%	3.3%	-	15%
Europe	87%	43%	3.0%	5.0%	3%	13%
China	40%	2.6%	10.1%	9.3%	-	60%
India	30%	-	-	-	-	70%

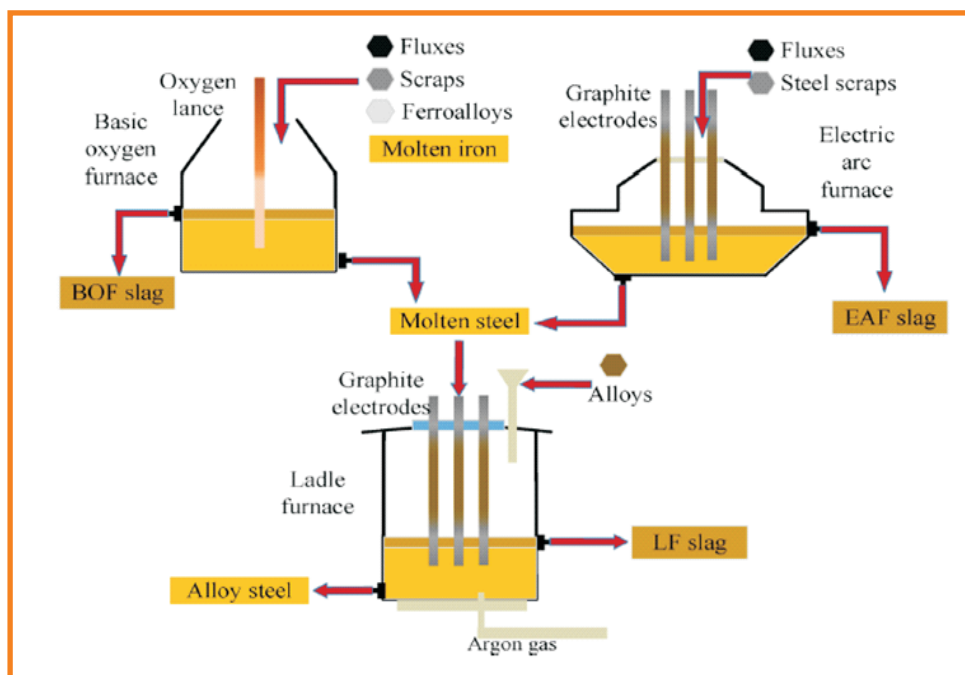


Fig. 1 Production process of different steel slags [Dong et al. 2021]

**2. Results and Discussion**

**2.1 Compressive Strength of Concrete**

Regular CS tests were carried out having w/c ratio of 0.42 to ensure the quality of the concrete. The test results for replacing coarse aggregate with various amounts of SS were analyzed. The CS test is carried out on samples that have been water-cured for 7, 28, and 56 days. It should be highlighted that, compared to standard concrete, the strength of concrete increased for all percentages of coarse SS replacement up to 40%. As 50% replacement results in reduced strength and 40% replacement results in more strength, further rising will reduce

strength. By using SS for coarse aggregate, concrete's strength is increased. However, the increasing replacement % of fine SS aggregate in concrete reduces its strength. The measurements showed that concrete strength improves for coarse SS aggregate up to 40% substitution level and gradually decreases fine SS aggregate in concrete with higher curing periods as shown in Fig 4.

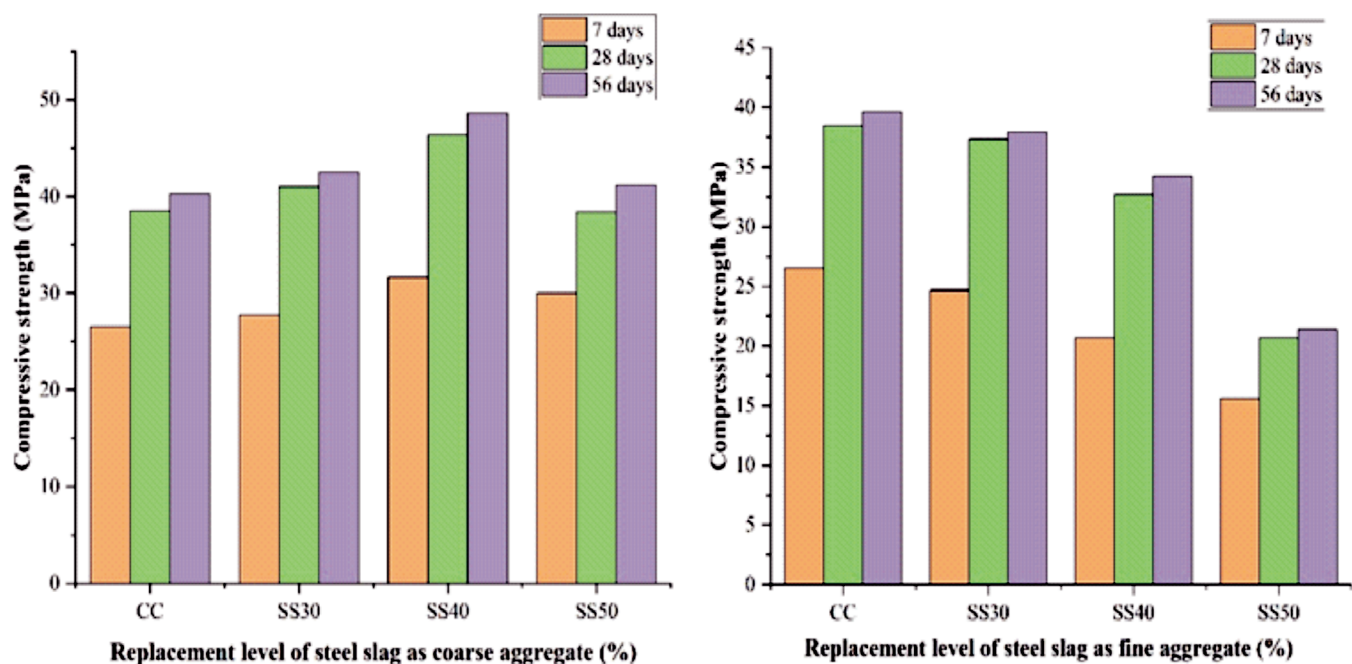


Fig. 2 Variation in CS with coarse and fine SS aggregate

The CS of conventional concrete is reported to have 26.53 MPa, 38.47 MPa, and 40.29 MPa for the period of 7, 28, and 56 days of curing, which further increased to the maximum strength of 31.67 MPa, 46.33 MPa, and 48.62 MPa for 40% substitution of coarse SS aggregate in concrete. Beyond the 40% substitution level, the strength is inferred to have lowered with higher SS content. At the same time, the variation in the strength is comparable with regular concrete. It could be due to the better mechanical properties of coarse SS aggregate than natural aggregate. SS's pores and rough surfaces are favorable because they can hold more water for hydration and strengthen the bond between the aggregate and cement mortar. Additionally, the addition of fine SS aggregates to concrete steadily decreased the CS of concrete with a higher replacement level. It might be because the strength of the concrete decreased with increasing substitution levels because of inadequate bonding between the cement and fine SS aggregate.

## 2.2 XRD analysis

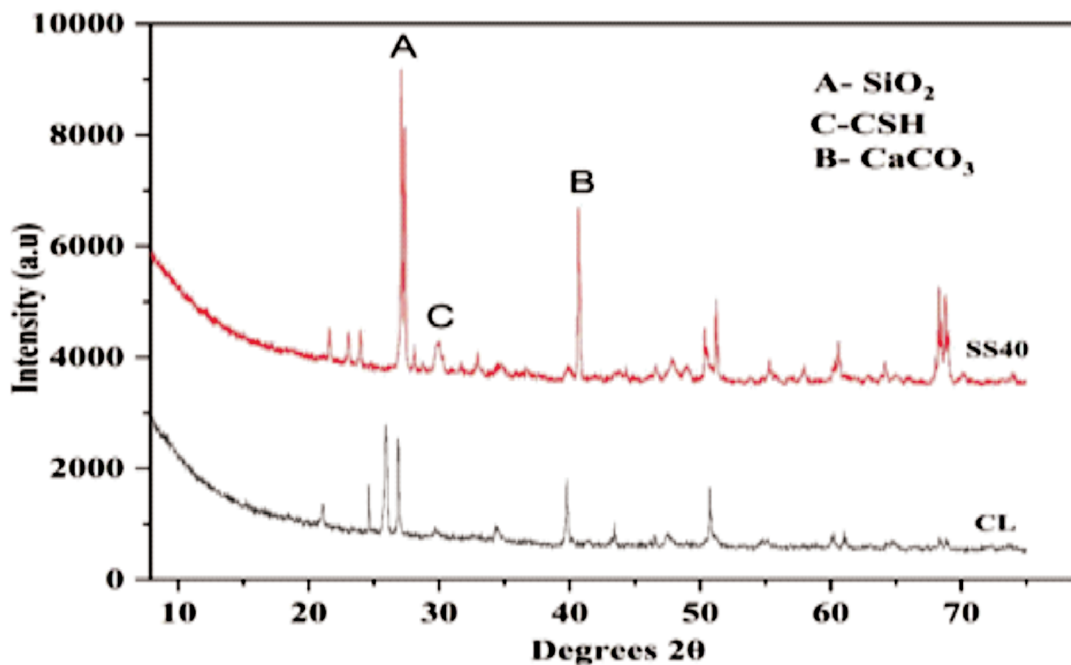


Fig. 3 XRD graph

XRD test results of concrete sample for 40% SS aggregate and conventional concrete revealed that major mineral components present in this concrete mix  $\text{SiO}_2$ , CSH gel and  $\text{CaCO}_3$  as shown in Fig. 3.

## 3. Conclusions

The current study looked into how steel slag affected the strength of concrete. The characteristics of concrete are significantly enhanced by the presence of steel slag. The current search was conducted in two phases. In the first stage, the impact of steel slag for various proportions (30%, 40%, and 50%) is completed. All of the cubes, beams, and cylinders are made with concrete that contains 40% steel slag aggregate in the second stage. Based on the results the following conclusions are drawn after a comparative study of concrete made with the steel slag aggregate concrete.

- For both regular concrete and steel slag aggregate concrete, the compressive strength of the concrete was evaluated using the slump cone test.
- The strength of concrete is improved when coarse aggregate is mixed with steel slag as coarse aggregate.
- The optimum outcome is obtained by substituting 40% steel slag for coarse aggregate.



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## **Mathematical Epidemiology: An Approach to Analyse the Mechanism of Disease Spread**

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Communicable diseases such as measles, influenza, and tuberculosis are facts of modern life. Some diseases, such as chicken pox, usually have mild symptoms and vanish of their own accord. Others, such as Ebola (recurrently) and COVID19, have appeared, causing a significant number of deaths, and then disappeared, but they raised the fear of catastrophic spread [1]. The prevalence and effects of many diseases in resource-constrained countries are probably less well known but may be of even more importance. Every year, millions of people die of measles, respiratory infections, diarrhea, and other diseases that are easily treated and not considered dangerous in the western world. Malaria, typhus, cholera, schistosomiasis, and sleeping sickness are endemic in many parts of the world. The effects of high disease mortality on mean life spans and disease debilitation and mortality on the economy in afflicted countries are considerable [2]. For diseases with no known treatment, it is possible to attempt control by isolating diagnosed patients and quarantining suspected victims to decrease transmission. However, it is impossible to do experiments to compare possible management strategies; the only way to attempt to compare the effectiveness of different approaches may be to formulate a mathematical model and use it to make predictions [3]. The emergence of efficient mathematical modeling techniques has made it possible to extract meaningful and comprehensive insight knowledge about epidemics. The development of the epidemiological model and numerical simulations allow comparing and analyzing the sensitivity and conjuncture paradigms. Moreover, it is possible to predict the arbitrator, the host, and the ecological hazards influencing community health, and therefore, health authorities can scientifically recommend and implement appropriate health services [4]. There have been many advances in disease management that have come from mathematical modeling. Two of the most striking are the recognition that mosquito management is the key to malaria control in a region and the realization that smallpox could be eradicated. However, there are many others. Given the importance of communicable diseases in history, it is natural that people would make efforts to understand the causes of diseases and search for treatments. This search leads naturally to an effort to construct models that focus on the main properties of a condition without necessarily attempting to include all the details.

## 1. Need of epidemic models

A model is an attempt to answer a question that begins with "Why?" The relation between problems and models in science may be described by the "flow chart" in Figure 1 [5]. The standard process of scientific progress is to observe a phenomenon, hypothesize an explanation and then devise an experiment to test the hypothesis. A mathematical model is a mathematical description of the situation based on the idea, and the solution of the model gives conclusions that may be compared with experimental results. This comparison usually requires numerical simulations to provide predictions that may be compared with observed data. In the mathematical modeling of disease transmission, as in most other areas of mathematical modeling, there is always a trade-off between simple models, which omit most details and are designed only to highlight general qualitative behavior, and detailed models usually created for specific situations, including short-term quantitative predictions. In 1910, Ross showed that malaria was transmitted through mosquitos and developed a model to describe the spread of malaria [6]. The 1920s saw the emergence of compartmental models. The Kermack–McKendrick epidemic model (1927) [7] and the Reed–Frost epidemic model (1928) [8] both describe the relationship between susceptible, infected, and immune individuals in a population. The Kermack–McKendrick epidemic model successfully predicted the behavior of outbreaks very similar to that observed in many recorded epidemics [8].

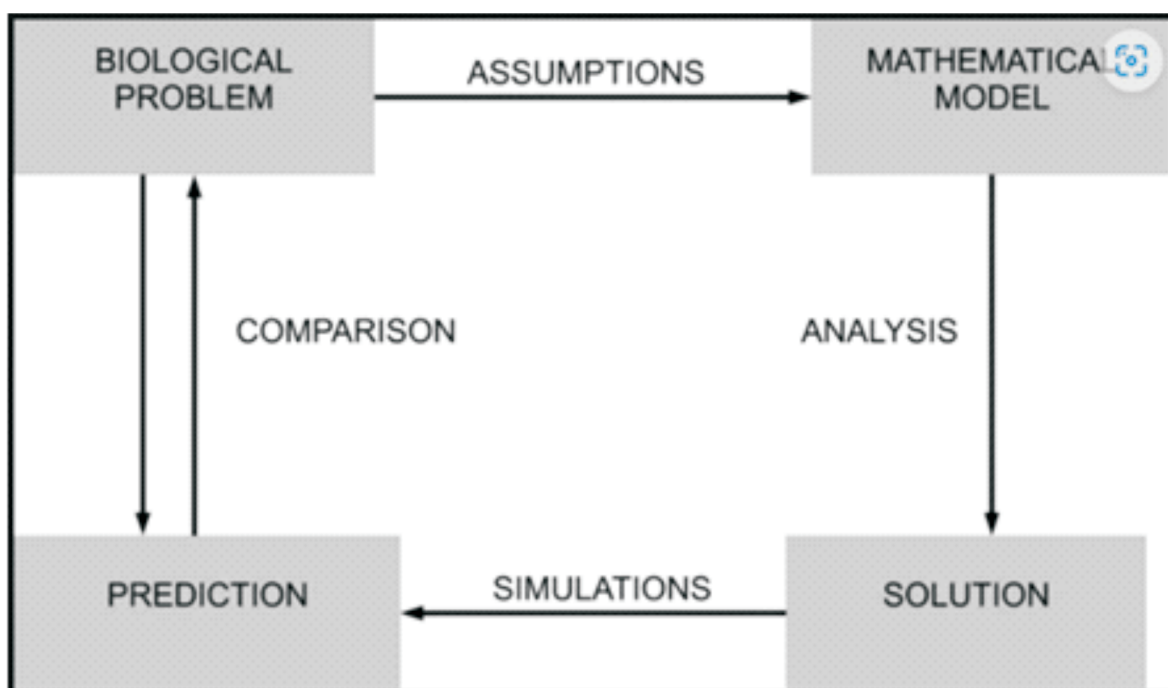


Fig. 1 A "flow chart" describing the relationship between scientific problems and models.

**2. Simple example of epidemic models**

A simple SIR compartmental epidemic model introduced by Kermack–McKendrick [7] in 1927 is one of the early triumphs of mathematical epidemiology where S, I, and R represents susceptible, infectious, and recovered population, respectively. This SIR model predicted behavior very similar to that observed in countless epidemics.

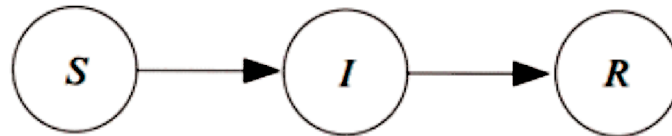


Fig. 2 Flow chart for the SIR model

In many diseases, infectives return to the susceptible class after recovery because the disease confers no immunity against reinfection. We use the terminology SIS model to describe a disease with no immunity against reinfection to indicate that the passage of individuals is from the susceptible class to the infective class and then back to the susceptible class. Figure 3 shows the flow diagram of SIS model. There are also SEIR and SEIS models, with an exposed period between being infected and becoming infective.

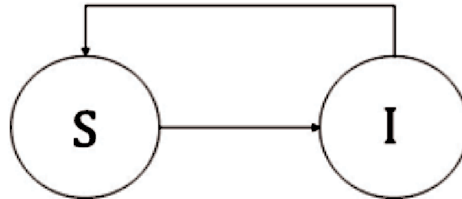


Fig. 3 Flow chart for the SIS model

Ross found that reducing the mosquito population could control malaria in a region [6]. This model was probably the first example of the threshold concept, which has been central in epidemiology ever since. The threshold principle is described quantitatively by the idea that the average number of secondary infections caused by an average infective is known as the primary reproduction number or basic reproductive ratio and is denoted by [9]. In epidemiological terms, these can be stated as: if the average number of secondary infections caused by a single infective introduced into a wholly susceptible population is less than one, a disease will die out, while if it exceeds one, there will be an epidemic.

**3. Future Challenges**

While many infectious diseases may pose huge problems in the near future, perhaps the two of the most current concern are pandemic influenza and HIV/AIDS. For both, there are

serious logistical questions concerning the availability and distribution of resources for management. Some basic questions are:

- How large a supply of drugs and medicines is needed?
- How can the necessary drugs and medicines be distributed?
- What happens to management strategies if the supply is insufficient?
- What might be the effects of the development of drug-resistant strains of infection?
- Can social distancing initiatives be helpful in disease management?

For HIV, one of whose aspects is the variation of infectivity with time since infection, detailed models will require an understanding of the development of the virus in a host; models will need to link immunology and the cell level with infection and the individual level. Another difficulty in understanding HIV is that HIV can be a dormant virus in immune cells. The study of HIV on a cell level is well underway, but there is much more to be done; some basic references are [10–15]. Another aspect of HIV is recognizing that transmission depends strongly on the heterogeneity of contacts. Because HIV/AIDS is a disease with complicated scientific properties, it is of great interest to theoretical modelers, and because HIV/AIDS is so widespread and devastating, it is of great interest to scientists and governments. It is reasonable to hope that sufficient funding for research and treatment may be forthcoming. Mathematical modeling has been a vital link between mathematics and physics for many years. A strong link between mathematics and epidemiology would lead to significant progress in epidemiological modeling. Currently, the mathematical content in the undergraduate education of students in the biological sciences is increasing, which should prove to be of great value in strengthening the links between mathematics and biology.

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## Internal Curing of Concrete

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Concrete infrastructure is an inseparable part of modern civilization. It provides support for housing, highway infrastructure, medical centres, hospitals, buildings and roadways. So far as the growth and survival of human societies are concerned, concrete is an essential component. As a foundation and building block of long lasting and reliable infrastructure, concrete has remarkable performance across social, economic, and environmental aspects. Curing plays an important role on strength development and durability of concrete. Curing takes place immediately after concrete placing and finishing, and involves maintenance of desired moisture and temperature conditions, both at depth and near the surface, for extended periods of time. Properly cured concrete has an adequate amount of moisture for continued hydration and development of strength, volume stability, resistance to freezing and thawing. Curing is possible in two ways. Internal curing and external curing. External curing methods were very popular. Those are ponding, spraying and fogging, saturated wet coverings, membrane curing. In the practical conditions external curing is not sufficient and not possible at inaccessible areas. Hence the internal curing gives the suitable solution for this. Internal curing of concrete is nothing but curing of concrete from inside to out as depict in figure 1.

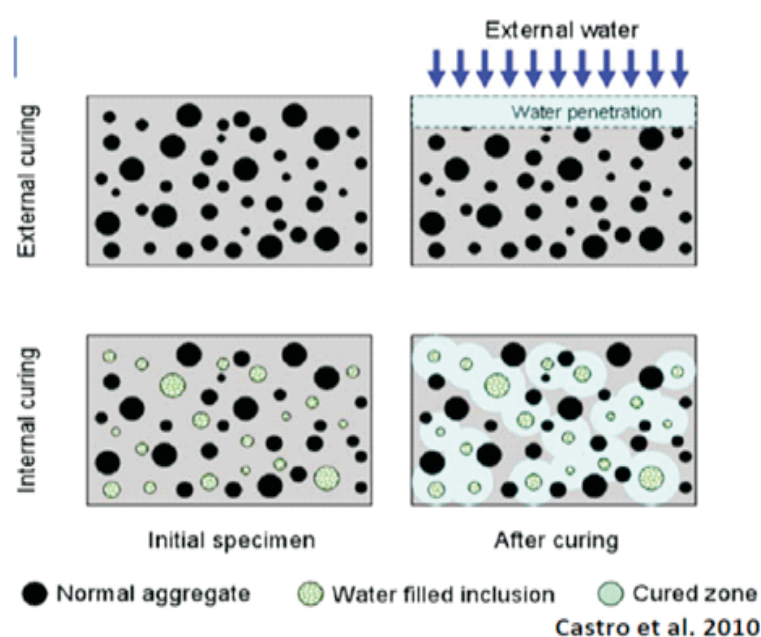


Fig. 1 Schematic diagram of internal curing of concrete

Concrete curing is necessary for one reason: cement hydration. Cement hydration is a series of chemical reactions that require an adequate water supply and proper temperatures over an extended time period (Taylor 2014). Curing is defined as “action taken to maintain moisture and temperature conditions in a freshly placed cementitious mixture to allow hydraulic cement hydration and (if applicable) pozzolanic reactions to occur so that the potential properties of the mixture may develop” (ACI 2013). Conventional concrete is typically cured using external methods. External curing prevents drying of the surface, allows the mixture to stay warm and moist, and results in continued cement hydration (Taylor 2014). Internal curing is a relatively recent technique that has been developed to prolong cement hydration by providing internal water reservoirs in a concrete mixture that do not adversely affect the concrete mixture's fresh or hardened physical properties. Internal curing grew out of the need for more durable structural concretes that were resistant to shrinkage cracking. High-performance concrete mixtures were developed due to a growing focus on durability (Hoff 2002) and are created by the use of lower water-cementitious materials (w/cm) ratios, chemical admixtures, and supplementary cementitious materials (SCMs). However, achieving such performance can only be achieved if the cementitious system is well hydrated, meaning that it has to be well cured (Meeks et al. 1999). If a concrete mixture is well cured, a benefit of using SCMs is decreased permeability (ACI [308-213]R-13 2013), especially at later ages. However, decreased permeability means that external curing is not as effective because the water cannot penetrate the system (Powers et al. 1959). Low w/cm ratio concrete mixtures, those with w/cm ratios less than about 0.42, do not have enough water to fully hydrate the cement in the mixture (Neville 1996). According to Byard and Schindler (2010), as the cement in a concrete mixture hydrates, water in the capillary pores is consumed. This process decreases relative humidity in the mixture and increases internal stresses, resulting in an increased risk of drying shrinkage and cracking (ACI [308-213]R-13 2013). To reduce the risk of drying shrinkage, it is necessary to mitigate the decrease in relative humidity in the mixture during hydration (Bentur et al. 2001). External curing does not meet this need because water cannot penetrate the full thickness of the element but is confined to a surface layer estimated to be about 1 inch thick at best. Moisture gradients can therefore develop in a concrete mixture as it hydrates (Mukhopadhyay et al. 2006), resulting in warping of pavements (Jeong and Zollinger 2004). In the late 1950s and 1960s, the benefit of internal curing from absorbed moisture in lightweight aggregate (LWA) was identified by pre-stressed concrete researchers (Campbell and Tobin 1967, 1 Jones and Stephenson 1957, Klieger 1957).



The concept of internal curing resurfaced in the 1990s when Philleo (1991) proposed the use of saturated lightweight fine aggregate in concrete mixtures to provide water to replace that depleted during cement hydration (Philleo 1991). Internal curing decreases the risk of cracking by providing additional water to a concrete mixture for the purpose of prolonged cement hydration without affecting the w/cm ratio (Delatte and Cleary 2008). Wei and Hansen (2008) have shown that warping in slabs on grade can be significantly reduced using internal curing (IC) concrete mixtures at w/cm ratios similar to those typically used for pavements. According to Byard and Schindler (2010), internal curing can be provided by highly absorptive materials that will readily desorb water into the cement pore structure. This will reduce capillary stresses and provide additional water for cement hydration. Materials that may be used for internal curing include LWA, super absorbent particles (SAP), perlite, and wood pulp. SAP, perlite, and wood pulp do not provide structural capacity to the concrete mixture, while LWA does (Byard and Schindler 2010).

#### Internal curing materials:

To be selected as an internal curing material, two basic requirements should generally be satisfied: (1) thermodynamic validity requires that the activity of water to be close to 1; and (2) dynamic validity requires that water can be easily released from the internal curing material when the relative humidity inside concrete drops. In the past, several materials have been employed as internal curing materials in the reported studies, such as bentonite, lightweight aggregate, Super absorbent polymer, porous ceramic aggregate, cenosphere and rice husk ash. Depending on the water absorption method, the internal curing materials can be classified as shown in figure 2.

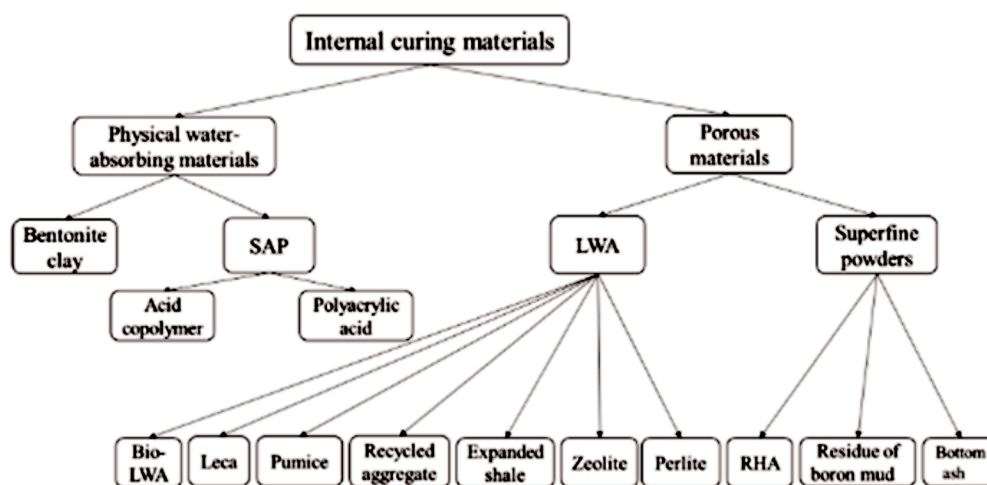
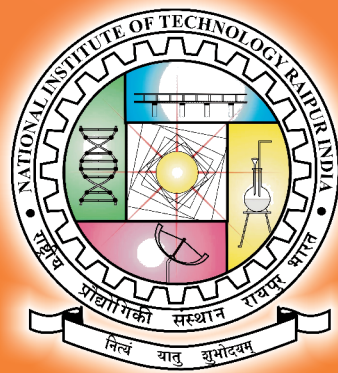


Fig. 2 Classification of internal curing materials.

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