

# Archit Bahirat

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<https://archit-2605.github.io/Portfolio>

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## EDUCATION

### Indian Institute of Technology Gandhinagar

B.Tech with Honours in Materials Engineering, CPI: 7.54

Gandhinagar, India

2020-2024

### M.P Junior College

HSC, Grade: 88.31 %

Pune, India

2018-2020

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## PUBLICATIONS

- Kumar, N., Sharma, A., **Bahirat, A.**, Joshi, G., & Khatua, S. (2023, June 6). Efficient Harvesting of >1000 nm Photons to Hydrogen via Plasmon-Driven Si-H Activation in Water. **The Journal of Physical Chemistry C**. <https://doi.org/10.1021/acs.jpcc.3c01454>. Our Research was featured on the **cover** of ACS Journal of Physical Chemistry C. Link: <https://pubs.acs.org/toc/jpccck/127/28>
- "Precise Management of Selectivity in Plasmonic photocatalysis via Si-H activation in the aqueous phase modulated by various excitation wavelengths and surface ligands influences"- Currently in advanced stage of writing Manuscript

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## INTERNSHIPS

### Summer Research Intern, University of Miami

May2023-July 2023

**Project Topic: Exploring the Photo-Thermal Effect: Investigation of Surface Temperature Changes in Gold Nanoprisms (AuTNPs) Exposed to different Laser Intensities** ; Advisor: Prof. Giacomo Po

- Successfully performed Finite Element Method (FEM) simulations utilizing COMSOL software to investigate surface temperature variations of gold nanoprisms under different intensities: 88mW/cm<sup>2</sup> and 100mW/cm<sup>2</sup>.
- Applied a plasmonic heating model to accurately predict and quantify the surface temperature changes in gold nanoprisms, enhancing the understanding of their photothermal response
- Executed detailed simulations and calculations to determine the temperature profiles of gold nanocubes, furthering insights into the relationship between nanoparticle morphology and photo-thermal behavior.

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## RESEARCH PROJECTS

**Multiscale Modeling and Experimental Validation of Photo-Thermal Effects in Plasmonic Photocatalysis Using Gold Triangular Nanoprisms**

Advisor: Prof. Saumyakanti Khatua and Prof. Soumyadip Sett, IIT Gandhinagar

Aug 2023-Present

- Utilized the RF and Heat Transfer modules within COMSOL Multiphysics to simulate the intricate interplay between electromagnetic radiation, heat generation and heat transfer process.
- Predicted the wavelength dependent (532nm,635nm and 808nm) change in temperature of surrounding medium as a function of time and distance from catalyst substrate during photocatalysis.
- Simultaneously performing experiments to validate the simulation results for temperature rise using thermocouple and IR camera.
- Developing sophisticated models to simulate plasmonic nanomaterials of complex morphology, enabling the accurate prediction of their optical properties.

### **Investigation of Changes in Mechanical Properties of Polyurethane with TiB<sub>2</sub> Nanosheets as Filler**

Advisor: Prof. Kabeer Jasuja, IIT Gandhinagar

Aug 2023-Present

- Carried synthesis of Titanium boride nanosheets from bulk TiB<sub>2</sub> using high energy ball-milling
- Currently, infusing different percentages of nanomaterial into polyurethane to design novel composite with enhanced mechanical properties.
- Utilizing methods such as UTM (Universal Testing Machine), DSC (Differential Scanning Calorimetry), and TGA (Thermogravimetric Analysis) for the comprehensive analysis of synthesized nanocomposites.

### **Tuning photocatalytic activity of Plasmonic nanoparticles through surface ligands**

Advisor: Prof. Saumyakanti Khatua, IIT Gandhinagar

Jan 2023-May 2023

- Engaged in the synthesis of AuTNPs, demonstrating proficiency in nanoparticle fabrication techniques.
- Attached various aromatic thiol ligands to the surface of AuTNPs and confirmed their presence by doing SERS(Surface Enhanced Raman Spectroscopy), enabling the investigation of their influence on photocatalytic performance.
- Designed and implemented dye degradation reactions, utilizing both 532nm and 808nm lasers for photocatalytic studies.

### **Effective utilization of NIR-II photons via plasmothermal Si-H activation**

Advisor: Prof. Saumyakanti Khatua, IIT Gandhinagar

May 2022-Jan 2023

- Gained valuable hands-on experience in synthesizing gold triangular nanoprisms (AuTNPs) and gold nanospheres (AuNS) as highly efficient photocatalysts.
- Conducted rigorous experimentation to fine-tune the photocatalysis parameters, enabling the optimization of reaction kinetics and improving the selectivity and reactivity of the process.
- Successfully converted organic industry waste into valuable products, demonstrating the feasibility of harnessing photocatalytic reactions for waste valorization. Due to novelty and excellent photon to hydrogen conversion, this work resulted in publication.

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## **COURSE PROJECTS**

### **Deposition of AlN films on SLG substrate**

Advisor: Prof. Emila Panda, IIT Gandhinagar

Feb 2023-April 2023

- Deposited Aluminum Nitride films of varying nitride concentration on glass substrate using RF-magnetron sputtering.
- Characterized the film using GIXRD, SEM imaging and UV-vis spectroscopy

### **Synthesis and Recrystallization of Ni-20Co Alloys**

Advisor: Prof. Pradipta Ghosh, IIT Gandhinagar

Feb 2023-April 2023

- Carried out synthesis of Ni-Co-20 alloy using electric arc melting, further samples were cold rolled at 50% and 80%
- Annealed the samples at different temperatures for about two hours and characterized using techniques like XRD, EDS and SEM.

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## **TEACHING EXPERIENCE**

### **Academic Discussion Hours Mentor**

- Provided guidance and mentored to students enrolled in the 'Materials for Future Course' and 'Materials Thermodynamics and Kinetics' at IIT Gandhinagar..
  - Organized and conducted regular weekly doubt clarification sessions, creating an interactive platform for students to address challenging concepts and enhance their understanding.
  - Offered patient and thorough explanations, helping students overcome difficulties and grasp key principles in the subjects.
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## SKILLS SUMMARY

**Instrumental Skills:** UV-Vis Spectrophotometer, FTIR, Gas Chromatography, Rotary Evaporator, Sonication, Centrifuge, ball milling, XRR, Spin-coating, Vacuum Oven, White Xe lamp, laser@ 532nm,808nm,635nm

**Practical Skills:** Sample preparation for NMR spectroscopy, LC-MS, GC: shape and size selective Au nanoparticle synthesis( AuNS, AuTNPs,)

**Software Skills:** : COMSOL Multiphysics, ORIGIN, MS Office, Autodesk Fusion 360, ANSYS, MATLAB

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## RELEVANT COURSES

Material Characterization Techniques, Thin Film Processing and Characterization, Computational Process Design, Nanoscale Science, Physics of Materials, Material thermodynamics and kinetics, Structure and Defects

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## POSITION OF RESPONSIBILITIES

**Event Coordinator Hallaboli'23 , IIT Gandhinagar**

*Feb 2023-March 2023*

- Assumed the responsibility of coordinating and ensuring the seamless execution of more than 13 diverse games during the intra-college sports fest 'Hallaboli'.
- Orchestrated the logistical aspects and operational details for each game, guaranteeing their smooth progression and successful outcomes.

**Class Representative, Materials Engineering Discipline, IIT Gandhinagar**

*Jan 2021-Sept 2022*

- Elected twice as the Class Representative for the Materials Engineering discipline, demonstrating trust and confidence from peers in leadership abilities.
  - Assumed a pivotal role in ensuring the effective operation of all classes within the discipline, fostering a conducive learning environment
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## ACHIEVEMENTS AND AWARDS

- Received prestigious '**AMALTHEA**' Scholarship. Awarded with INR 1,50,000 (1815 USD) for being selected as Summer Intern at **University of Miami**.
- Cracked JEE Advanced examination, toughest engineering entrance exam in India and got admitted to one of the premier engineering college in India, IIT Gandhinagar.

## EXTRACURRICULAR ACTIVITIES

- Participated in Inter-College swimming competition and part of Institute water polo team.
  - **COVID Task Force Volunteering:**  
Contributed to implementing and overseeing COVID safety protocols for a secure campus environment.
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