ASM INTERNATIONAL

PUNE CHAPTER

Issue No. 53 | March, 2026

CHAPTER NEWS LETTER

EDITORIAL...

Dear Readers,

Warm greetings on this special occasion of Women's Day. This year's theme, "Give to Gain," beautifully reflects a truth that defines both progress and leadership. When women contribute their knowledge, resilience, and creativity to their fields, society gains innovation, strength, and forward momentum. Growth is reciprocal. The more we invest in empowering women, the more transformative the outcomes become across industries and communities.

In the realm of materials science and additive manufacturing, women have steadily reshaped the boundaries of possibility. Additive manufacturing is redefining how we design, prototype, and produce, from aerospace components to biomedical implants. Women researchers and engineers have played a critical role in advancing powder metallurgy, polymer processing, lattice optimization, and sustainable material development within this rapidly evolving domain. They are influencing industry standards, leading interdisciplinary research, and driving technological adoption at scale. Their achievements remind us that innovation flourishes when talent is nurtured and opportunity is shared.

At the Material Advantage Chapter, CCOEW Nagpur, we are dedicated to supporting aspiring women in mechanical engineering and materials science by strengthening their technical foundation and professional confidence.

We extend our heartfelt congratulations to the ASM Pune Chapter for this special Women's Day edition of the newsletter focused on Materials in Additive Manufacturing. Highlighting this theme is both timely and visionary. It draws attention to a field that represents the future of manufacturing while honoring the women whose persistence and intellect are strengthening its foundation.

As we celebrate the achievements of women in materials science and additive manufacturing, let us embrace the spirit of giving to gain. When we mentor, include, and uplift, we cultivate stronger institutions and richer innovation. May this Women's Day inspire us to continue investing in talent, fostering inclusivity, and building a future where every capable mind is empowered to contribute fully.

Wishing everyone a very Happy Women's Day.

May we continue to give generously, learn continuously, and gain collectively through shared progress.

~ **THE EDITORIAL TEAM**

ASM INTERNATIONAL PUNE CHAPTER

CHAPTER NEWSLETTER

ISSUE NO. 53 | MARCH 2026

MESSAGE FROM CHAIRMAN

To all women breaking glass ceilings and building new floors—celebrating the brilliance, bravery, and beauty everywhere today.
Happy International Women's Day!

D.G.CHIVTE
(CHAIRMAN,
ASM PUNE CHAPTER)

MA CHAPTER CCOEW NAGPUR ACTIVITIES 2025-26

The 2025–26 session for the Material Advantage Student Chapter (MASC) at CCOEW, Nagpur, has been a masterclass in bridging the gap between classroom theory and corporate reality. The journey toward professional excellence began with a focus on leadership and strategic planning, highlighted by the T-Shirt Distribution Ceremony on August 5th. Under the mentorship of Mr. Yogesh Dandekar and Prof. Sushil Lanjewar, the newly appointed Executive Committee was formally inducted, creating a unified front to spearhead the year's ambitious technical initiatives.

Direct mentorship from successful alumnae served as a cornerstone for student development throughout the semester. On August 2nd, Ms. Shanulika Walke from Siemens India Ltd. shared vital placement strategies with 90 participants, emphasizing the mastery of core mechanical competencies. This was followed on September 9th by an insightful session with Ms. Shruti Dhole of TechnipFMC, who provided a deep dive into the global energy sector. Her discussion on subsea production and the necessity of "presence of mind" during interviews provided students with a realistic roadmap for navigating the complexities of the oil and gas industry.

MA CHAPTER CCOEW NAGPUR ACTIVITIES 2025-26

Beyond career guidance, the chapter fostered a culture of innovation and interdisciplinary research. On August 7th, the DocVerse competition challenged 47 students to explore futuristic domains like Nanomaterials and Quantum Materials through the lens of documentary filmmaking. This spirit of inquiry was further channeled into the Technical Article Writing Competition, which focused on the theme of Additive Manufacturing. By the submission deadline of September 27th, students had contributed 13 well-researched papers on the materials and advancements in 3D printing, with the top entries earning a prestigious place in the inaugural edition of the chapter's newsletter, The Beacon.

DOCVERSE COMPETITION

TECHNICAL ARTICAL COMPETITION

The semester reached its technical peak on October 30–31 during a high-impact collaboration with PMI India Pvt. Ltd. Held at the Gargi Seminar Hall, this two-day seminar focused on the real-world applications of AutoCAD in design and manufacturing. The event proved to be more than a training session; it served as a direct career gateway by offering exclusive, result-oriented internship opportunities to deserving candidates.

The success of these initiatives is reflected in the growing confidence and technical calibre of our students, ensuring that CCOEW students are prepared to lead the next generation of engineering innovation.

OPPORTUNITY DRIVES DISCOVERY

For women in STEM, International Women's Day is a moment of rightful recognition. Scientific and technological history is rich with women whose intellectual rigor reshaped the modern world, even when their contributions were minimized or overlooked. The pioneering research of Marie Curie transformed physics and medicine. The precise orbital calculations of Katherine Johnson made early space missions possible. The structural insights of Rosalind Franklin were indispensable to understanding DNA. In materials science, figures such as Julia Weertman advanced the study of nanocrystalline metals, fundamentally influencing modern metallurgy and structural applications. These examples are not anomalies but reminders that scientific progress has always depended on diverse intellect. Women's Day restores that perspective and insists that history be told with completeness and integrity.

JULIA WEERTMAN-THE FIRST WOMAN IN THE U.S. TO CHAIR A MATERIALS SCIENCE AND ENGINEERING DEPARTMENT

WOMEN MAKE UP APPROXIMATELY 46% OF ALL MATERIALS SCIENTISTS

It is also a day of reflection on the structural barriers that continue to shape STEM environments. Gender bias, uneven access to leadership roles, and disparities in funding or recognition remain persistent challenges. Women's Day is therefore not ceremonial alone; it is corrective. It calls upon institutions to evaluate merit with objectivity and to cultivate cultures where authority arises from expertise rather than conformity to outdated expectations. True innovation demands intellectual plurality, and systems that exclude talent ultimately undermine their own excellence.

Representation remains transformative. When young girls witness women leading research laboratories, designing complex systems, publishing influential papers, and teaching advanced engineering courses, the boundaries of possibility expand. Visibility quietly reshapes ambition. The cultural narrative shifts from questioning whether women belong in STEM to strengthening pathways that support their success. International Women's Day amplifies this shift and reinforces the responsibility to build ecosystems where aspiration is met with opportunity.

The theme “give to gain” resonates deeply within this context. When institutions give equitable access, mentorship, and recognition, they gain stronger research, broader perspectives, and more resilient innovation. When women in STEM give their intellect, discipline, and creativity to their fields, society gains solutions that are more comprehensive and humane. Progress is reciprocal. Advancement flourishes when opportunity is shared.

On a personal level, the day offers affirmation and solidarity. STEM disciplines can be demanding, and at times isolating, particularly for those underrepresented in their environments. Community strengthens perseverance. Women’s Day serves as a reminder that persistence in science, engineering, and mathematics contributes not only to individual achievement but to collective advancement. It affirms a fundamental principle: innovation reaches its highest potential when every capable mind is empowered to contribute without limitation.

DID YOU KNOW?

INDIA HAS THE HIGHEST PERCENTAGE OF WOMEN STEM GRADUATES GLOBALLY, REACHING 40-43%!

MEET 7 TRAILBLAZING INDIAN WOMEN SHAPING SCIENCE AND TECHNOLOGY

It's 2026 and women in India are no longer just participants in STEM- they are visionary innovators and leaders actively paving their own unique paths. From AI labs to conservation projects, they are transforming science and technology in ways the world is only beginning to comprehend.

Women have historically been underrepresented in science, technology, engineering and mathematics, yet today the tides have turned and how! Empowered by the increasing workforce participation, upskilling initiatives, mentorship programmes and inclusive workplace policies, women have claimed their rightful space in AI, sciences and other cutting edge fields. India is a growing hub of STEM talent, generating unprecedented opportunities for innovators.

This article celebrates Indian women who are fearlessly breaking barriers and inspiring the next generation. Their work is a powerful reminder that with access and opportunity, women in STEM are shaping the future.

1. Dr Rajula Srivastava

Dr Rajula Srivastava, an Assistant Professor at the University of Wisconsin-Madison, won the 2025 Maryam Mirzakhani New Frontiers in Mathematics Prize, a prize awarded to exceptional Doctoral women mathematicians. It comprises a monetary award of $50,000. She shared her wish to donate part of her prize money to Indian organisations supporting children's education.

Dr Srivastava served as a Hirzebruch Research Instructor, working across the Mathematical Institute Bonn and the Max Planck Institute for Mathematics (MPIM). Her research sits at the intersection of harmonic analysis and number theory.

DR RAJULA SRIVASTAVA

DR DIVYA KARNAD

2. Dr Divya Karnad

Dr Divya Karnad is a marine conservationist and Associate Professor at Ashoka University, India. She was honoured as the 2025 WINGS Woman of Discovery for her interdisciplinary work in advancing sustainable fisheries, protection of marine biodiversity and community centred conservation. Her work is rooted in the confluence of science, policy and indigenous knowledge to address the human dimension of ocean stewardship.

3. Amrita Krishnamoorthy

Amrita Krishnamoorthy was honoured with the Unlock Her Future Prize 2025 in the United Kingdom, awarded to innovators leading social change to address South Asia's most pressing challenges. Her organisation Stepping Stones Center, promotes the practice of Applied Behaviour Analysis (ABA) to support children with Autism Spectrum Disorder and other developmental disabilities. Her evidence-based interventions approach is grounded in the belief that every child is capable of exceeding their potential with the right instructional support.

4. Jhillika Trisal

Jhillika Trisal, also a recipient of the Unlock Her Future Prize 2025, has redesigned learning with her startup Cognitii; a mobile first, AI powered ecosystem that supports schools in identifying learning needs early and personalise support for children with development and learning disabilities while mitigating workload on educators. The initiative is providing much needed infrastructure to Indian schools to screen early, support effectively and meaningfully engage neurodivergent learners across education systems.

5. Lakshmi Chinthala

A researcher at Golden Gate University, Chinthala developed Smart DaaS, an AI driven diagnostic solu around the wearable platform HIVSense Econ. It is a game changing health-tech innovation that merge and edge-AI biosensing to detect HIV biomarkers such as viral RNA and p24 antigen, accelerating ear care especially in under-resourced regions. Chinthala's innovation offers a scalable public health tool potential for transforming HIV diagnosis worldwide.

AMRITA KRISHNAMOORTHY

JHILLIKA TRISAL

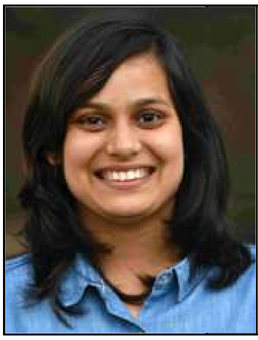
LAKSHMI CHINTHALA

6. Rashi Jain

Researchers Rashi Jain and Yogesh Wadadekar from the Tata Institute of Fundamental Research, using NASA's James Webb Space Telescope (JWST) identified 'Alaknanda', a galaxy strongly akin to the Milky Way but which apparently formed when the universe was 1.5 billion years old. The two astronomers observed JWST images of the galaxy through 21 varied filters to determine Alaknanda's distance, stellar mass and star-formation rate. This discovery compels astrophysicists to rethink timelines for galaxy formation.

7. Dr Purnima Devi Burman

Dr Purnima Devi Barman, a wildlife biologist from Assam was conferred as one of the TIME Magazine's Women of the Year 2025. As the founder of Hargila Army, she led an all women movement of over 20,000 rural women fighting to protect the endangered Greater Adjunct Stork (Hargila). Her team ensures that nesting habitats are safe, fallen chicks are rescued and the wetland ecosystems are restored. Her endeavours helped usher a rebound in the stork population in Assam – leading to reclassification of Hargila from 'endangered' to near 'threatened'.



RASHI JAIN

DR. PURNIMA DEVI BURMAN

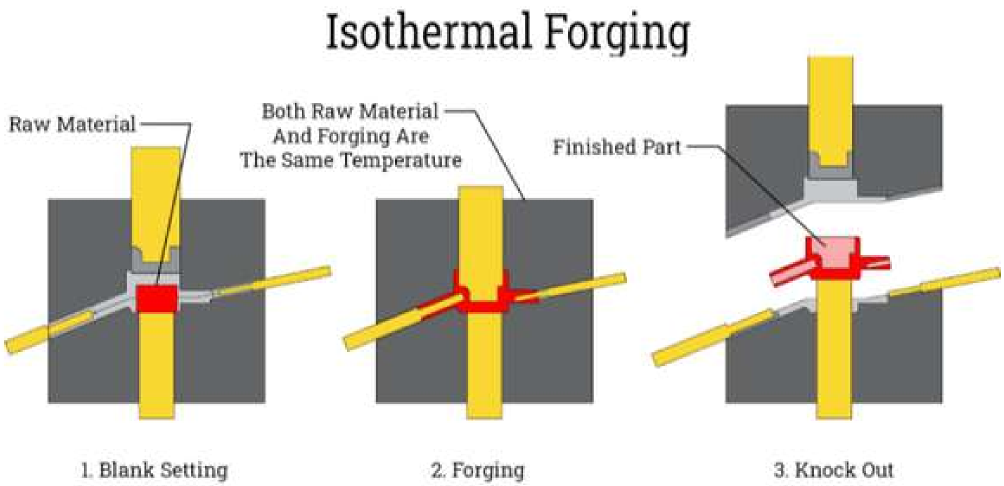
In honor of International Women's Day, this edition celebrates the ingenuity of female students leading the way in Vat Photopolymerization (VPP). These activities aren't just about technical specs; they represent a move toward breaking barriers in a traditionally male-dominated field. From mastering the chemistry of UV-curable resins to fine-tuning high-precision 3D prints, these student-led articles highlight the diverse voices and fresh perspectives driving the future of engineering. It's a practical look at how the next generation of women in STEM are advancing tangible innovation.

DID YOU KNOW?

SIXTY WOMEN HAVE BEEN AWARDED THE NOBEL PRIZE BETWEEN 1901 AND 2022.

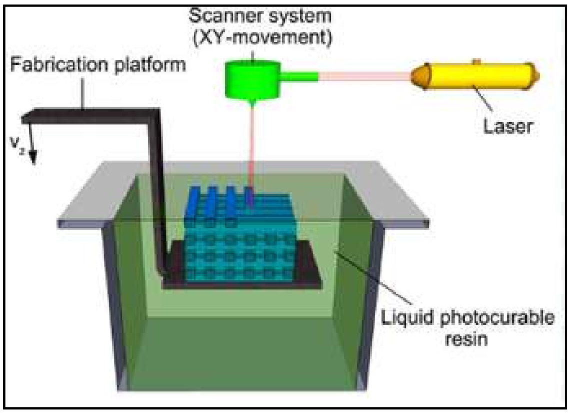
VAT PHOTOPOLYMERIZATION: LET'S LIQUID FORGE

Imagine transforming a vat of viscous liquid resin into a fully solid, dimensionally precise prototype overnight. That is the power of vat photopolymerization, one of the most mature and precise forms of additive manufacturing. First conceptualized by Chuck Hull in 1984 and formalized under U.S. Patent 4,575,330 in 1986, this technology laid the foundation for modern 3D printing. The global vat photopolymerization market is estimated at roughly 1.3 billion USD in 2024 and is projected to exceed 5 billion USD by 2035, driven by rapid adoption in healthcare, dentistry, aerospace, consumer electronics, and microfluidics.



Traditional manufacturing methods such as injection molding or precision machining often require tooling costs exceeding 10,000 USD per mold, with lead times of several weeks and material waste that can reach 60 to 90 percent depending on subtractive processes. For highly customized applications such as patient specific implants, hearing aids, dental aligners, or aerospace components containing 0.1 millimeter internal channels, those economics become impractical. Vat photopolymerization reduces material waste to under 5 percent in most builds and enables layer thicknesses between 25 and 100 microns, with advanced systems reaching 10 microns. Dimensional tolerances can fall within plus or minus 0.05 millimeters, and surface roughness values under Ra 5 micrometers are common, approaching CNC level finishes without secondary machining.

Technically, the process relies on liquid photopolymer resins composed of acrylates or epoxies combined with photoinitiators that react under specific wavelengths, typically 355 to 405 nanometers. In stereolithography systems, a focused UV laser scans at speeds approaching 200 to 300 millimeters per second, selectively curing cross sections of the model. In digital light processing systems, a digital micromirror device projects entire layers simultaneously, improving throughput. More recent LCD based masked systems have reduced equipment cost while maintaining pixel resolutions near 35 to 50 microns. Emerging volumetric tomographic photopolymerization can solidify entire geometries in seconds by projecting dynamic light fields into rotating resin volumes, significantly reducing print times compared to traditional layer by layer methods.



The workflow remains elegantly digital. Engineers design components in CAD platforms such as SolidWorks, export STL files and slice them using tools like ChiTuBox or proprietary software. Build platforms operate typically between 25 and 35 degrees Celsius to maintain resin viscosity stability. After printing, parts are rinsed in isopropyl alcohol for 10 to 30 minutes, then post cured under UV at around 60 degrees Celsius for one to two hours to maximize polymer cross linking. In biomedical applications, this approach has enabled rapid prototyping of microfluidic diagnostic chips within two hours, improving fluid channel efficiency by up to 30 percent compared to traditionally machined prototypes that may require weeks.

Early systems faced legitimate limitations. Resin tensile strength often hovered near 40 megapascals with elongation at break below 10 percent. Shrinkage during curing could reach 1 to 4 percent, and support structures left surface artifacts on approximately 20 percent of exposed areas. Build volumes were typically constrained to 300 by 300 by 400 millimeters. Today, high performance engineering resins exceed 80 megapascals tensile strength, with flexible variants achieving elongations above 200 percent. Biocompatible resins now comply with ISO 10993 standards for medical applications. Large format SLA systems support build volumes exceeding 800 millimeters in one axis and hybrid multi material systems enable gradient structures with variable stiffness within a single print. Sustainable formulations derived partially from vegetable oils are reducing reliance on petrochemicals, and lifecycle assessments indicate up to 90 percent less material waste compared to subtractive machining for complex geometries.

The technology is especially dominant in dental manufacturing, where over 90 percent of clear aligners and dental surgical guides are produced via vat photopolymerization processes. In aerospace and automotive prototyping, weight reductions of 30 to 50 percent are achieved through topology optimized lattices that would be impossible to machine conventionally. Research laboratories are pushing further into micro optics, soft robotics and tissue engineering scaffolds, where resolution below 20 microns becomes transformative.

FARIHA KAUSAR
(3RD YEAR ME)

DID YOU KNOW?

MATERIALS CAN BE PRINTED THAT CHANGE SHAPE OR PROPERTIES IN RESPONSE TO ENVIRONMENTAL FACTORS LIKE WATER, HEAT, OR LIGHT OVER TIME.

PRECISION MANUFACTURING THROUGH LIGHT

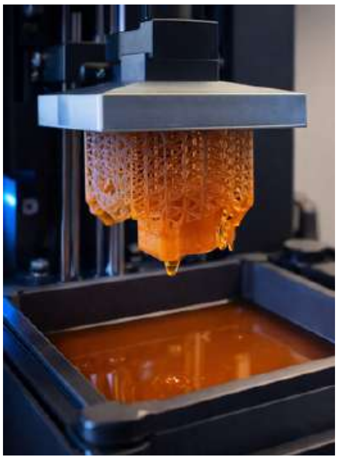
As engineering students, we frequently work on solving design problems using theoretical knowledge and CAD models. However, transforming those digital designs into physical prototypes is often the most challenging part of the process. Traditional manufacturing methods can be time-consuming, expensive and sometimes unsuitable for producing complex geometries during early design stages. This is where Vat Photopolymerization (VPP) becomes highly relevant in modern engineering practice.

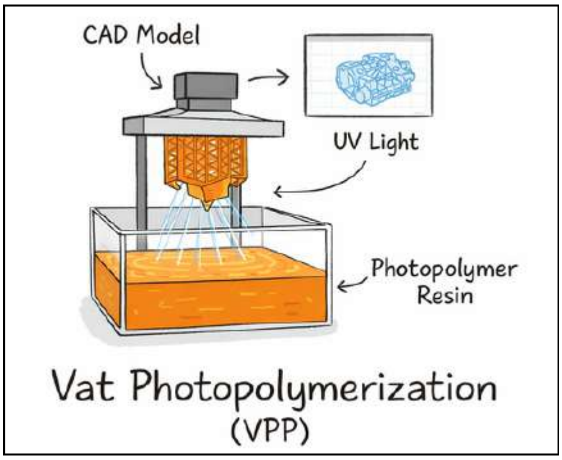
Vat Photopolymerization is a resin-based 3D printing process in which liquid photopolymer resin is selectively cured using a controlled light source, usually ultraviolet (UV) light. The component is built layer by layer inside a resin vat, following a digital CAD model.

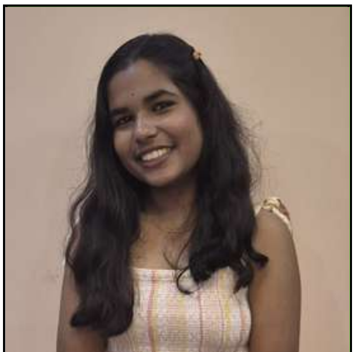
One of the best things about VPP is its high precision. In fields like biomedical engineering, electronics and product design, even small errors matter. VPP helps us create thin walls, sharp edges and complex shapes that are difficult to make using traditional methods. Since it works directly from CAD models, design changes can be made and printed quickly without extra tools.

Once the design is made in CAD software, it is sliced into layers and sent to the printer. The resin is cured layer by layer using light and after printing, the part is cleaned and post-cured to improve strength. If changes are needed, the design can be quickly modified and reprinted, making the process fast and efficient for testing.

Overall, Vat Photopolymerization shows how light-based manufacturing can simplify the journey from design to prototype. Its high accuracy, smooth surface finish, and quick design flexibility make it a valuable tool in modern engineering. For students and engineers, understanding VPP is important as it plays a key role in precision manufacturing and future product development.







SAMRUDDHI JAISWAL
(2ND YEAR ME)

FROM PROBLEM TO PROTOTYPE

In modern industries such as medical, dental, jewelry, aerospace, and product design manufacturing highly detailed and complex components is a major challenge. Traditional manufacturing methods like machining and molding often fail to produce intricate geometries with high precision.

To overcome these limitations, Vat Photopolymerization (VPP) has emerged as an advanced additive manufacturing technology that enables accurate, smooth, and detailed prototype development.

Lets consider the Medical & Dental Industry as an example.

<u>The medical industry requires:</u>

1. Customized dental crowns
2. Surgical guides
3. Hearing aid shells
4. Microfluidic components

<u>Problems with Traditional Manufacturing in These Industries:</u>

1. Complex internal structures are often impossible to manufacture.
2. CNC machining cannot easily create enclosed cavities.
3. High tooling costs.
4. Molds are expensive for small production batches.
5. Long production times.
6. Multiple machining and finishing steps required.
7. Surface finish issues.
8. Rough surfaces require extra polishing.
9. Limited customization
10. Mass production methods are not suitable for patient-specific parts.

This results in slow prototyping and high production cost.

PROCESSES INVOLVED IN VPP

Vat Photopolymerization (VPP) is a 3D printing process where a vat is filled with liquid photopolymer resin. UV light selectively cures the resin layer by layer. The object then solidifies to form a precise 3D structure.

Let's go through the Step-by-Step Process of VPP:

1. CAD model is created.
2. Model is sliced into thin layers.
3. UV light cures liquid resin layer-by-layer.
4. Build platform moves upward.
5. Final part is washed and post-cured.

Prototype Development Flow:

Problem ↘ CAD Design ↗ Slicing ↘ VPP Printing ↗ Washing ↘ UV Curing ↗ Final Prototype

VPP is a Superior Solution because:

1. Extremely High Accuracy: It has a resolution up to 25–50 microns and hence is ideal for micro-components
2. Smooth Surface Finish: Minimal post-processing required
3. Complex Geometric Capabilities: Internal channels, lattice structures possible
4. Rapid Prototyping: Design to prototype in few hours
5. Mass Customization: Perfect for patient-specific medical parts

The major industrial problem is not just manufacturing parts — it is manufacturing precise, complex and customized parts efficiently. Vat Photopolymerization transforms the process from a slow, expensive manufacturing cycle to a fast and accurate prototyping solution.
Therefore, Vat Photopolymerization is not just a 3D printing technique; it is a revolutionary step from problem identification to rapid prototype realization.

TARINI KOLHE
(2ND YEAR MECH)

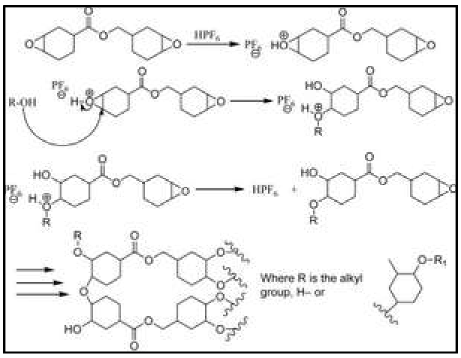
DID YOU KNOW THAT RESIN PRINTING WAS USED IN 1900S TO SAVE LIVES? SCAN THIS QR TO SEE HOW

MYSTICAL MATERIALS

Acrylate- and methacrylate-based photopolymers form the backbone of most vat photopolymerization systems. These materials polymerize predominantly through free-radical mechanisms, initiated when photoinitiators absorb UV or near-UV radiation and generate reactive radical species. Multifunctional acrylates enable rapid chain propagation and dense crosslink formation, which translates to high stiffness and dimensional accuracy. However, this same rapid crosslinking often induces volumetric shrinkage and residual stress accumulation. The molecular architecture—specifically the functionality of the monomer and the molecular weight of oligomeric precursors—dictates the tensile strength, modulus, and brittleness. By manipulating crosslink density and incorporating urethane linkages, formulators mitigate crack propagation while preserving structural integrity.

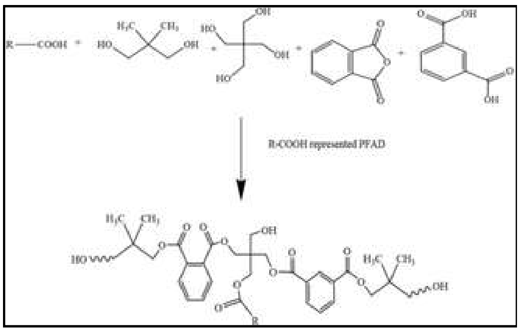
Epoxy-Based Cationic Photopolymers offer an alternative polymerization pathway governed by cationic ring-opening reactions. Unlike free-radical systems, epoxy networks exhibit reduced oxygen inhibition and lower polymerization shrinkage, attributes that enhance dimensional fidelity and thermal stability. The cationic mechanism continues even after irradiation ceases, a phenomenon known as “dark curing,” which contributes to higher ultimate conversion. These materials are particularly valued in applications demanding elevated heat deflection temperatures and chemical resistance. Aromatic epoxy backbones increase rigidity, while cycloaliphatic epoxides balance reactivity with mechanical toughness. Moisture sensitivity, however, remains a kinetic constraint, necessitating controlled processing environments.

Urethane-Acrylate Toughened Resins are engineered to reconcile stiffness with impact resistance. Incorporating flexible urethane segments into acrylate networks introduces hydrogen-bonding interactions and microphase-separated domains that absorb strain energy. The result is a photopolymer capable of substantial elongation before fracture, often exceeding 100 percent elongation at break. These materials emulate thermoplastic behavior despite their thermoset nature. By tailoring oligomer backbone flexibility and chain entanglement density, material scientists fine-tune fracture toughness and fatigue resistance, making these systems suitable for snap-fit assemblies and dynamically loaded components.



CATIONIC PHOTOPOLYMERIZATION PROCESS (L)

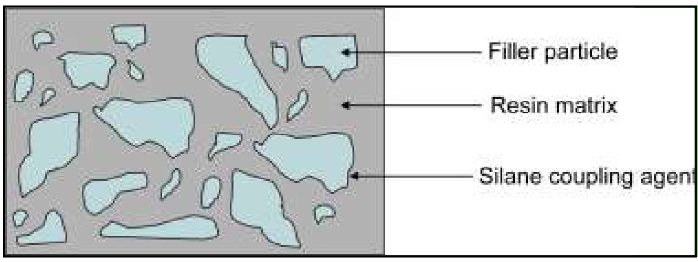
URETHANE-ACRYLATE TOUGHENED RESIN (R)



Ceramic- and silica-filled Composite Resins extend the performance envelope of photopolymers into high-modulus, thermally resilient territory. Dispersing inorganic particulates such as alumina, zirconia, or fused silica within a photocurable matrix enhances stiffness, wear resistance, and heat deflection temperature. The interfacial adhesion between filler and polymer matrix becomes critical; silane coupling agents are frequently employed to improve load transfer efficiency. Yet filler incorporation introduces optical scattering, which attenuates photon penetration depth and complicates cure kinetics. Achieving homogeneous dispersion while maintaining adequate light transmission represents a delicate balance between rheology and photochemistry.

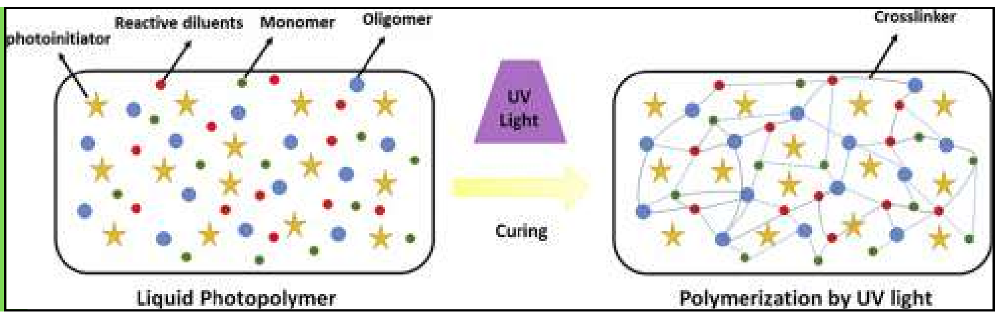
Elastomeric Polyurethane Photopolymers are formulated with long-chain aliphatic oligomers that reduce crosslink density and promote segmental mobility. These materials exhibit low Shore hardness values and exceptional elasticity, making them indispensable in soft robotics, wearable devices, and damping applications. Their mechanical response is governed not merely by covalent crosslinks but also by reversible physical interactions within the polymer network. However, increasing flexibility often compromises tear resistance and long-term mechanical stability, prompting ongoing research into reinforced elastomeric formulations.

Biocompatible Methacrylate and Hydrogel Systems are tailored for medical and dental applications, where cytocompatibility and sterilization resistance are paramount. Highly purified methacrylate monomers minimize residual extractables, while controlled post-curing maximizes monomer conversion. Hydrogel-based systems, frequently derived from polyethylene glycol diacrylate (PEGDA), introduce hydrophilicity and tunable porosity. These networks facilitate nutrient diffusion and cellular integration, enabling applications in tissue scaffolding and regenerative medicine. The delicate interplay between crosslink density and swelling behavior determines mechanical robustness and biological functionality.



CERAMIC FILLED COMPOSITE RESINS

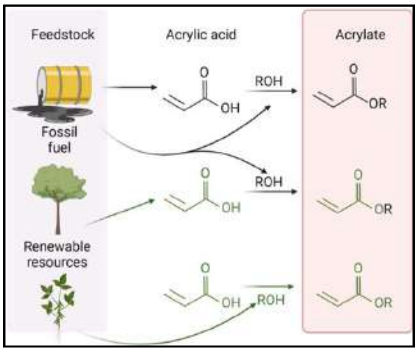
POLYURETHANE PHOTOPOLYMERS FORMATION



Bio-Based Acrylate Resins represent an emergent class derived from renewable feedstocks such as soybean or castor oil derivatives. By chemically modifying triglyceride structures into photocurable acrylates, researchers reduce reliance on petrochemical monomers without sacrificing performance. Although early bio-based systems suffered from inferior mechanical strength, advances in functionalization chemistry have significantly improved modulus and tensile properties. These formulations contribute to sustainability efforts, though lifecycle assessment and recyclability remain complex due to their thermoset architecture.

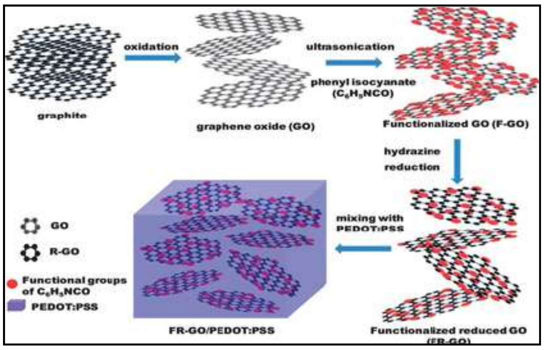
Nanocomposite Photopolymers with Graphene or Carbon Nanotubes introduce multifunctionality beyond structural performance. Incorporating nanoscale conductive fillers imparts electrical conductivity and enhanced thermal transport properties to otherwise insulating polymer matrices. The dispersion state of nanoparticles is critical; agglomeration not only undermines mechanical reinforcement but also disrupts optical clarity, impeding photopolymerization efficiency. Rheological modification and surface functionalization techniques are therefore essential to maintain homogeneous distribution while preserving cure depth.

Collectively, these materials illustrate that vat photopolymerization is governed as much by molecular engineering as by mechanical precision. Each resin system embodies a carefully orchestrated balance among reactivity, crosslink density, thermal behavior, and mechanical response. As polymer chemistry advances—through dynamic covalent networks, vitrimeric systems, and adaptive composites—the material landscape of vat photopolymerization continues to expand, redefining the boundaries between prototyping and true manufacturing.



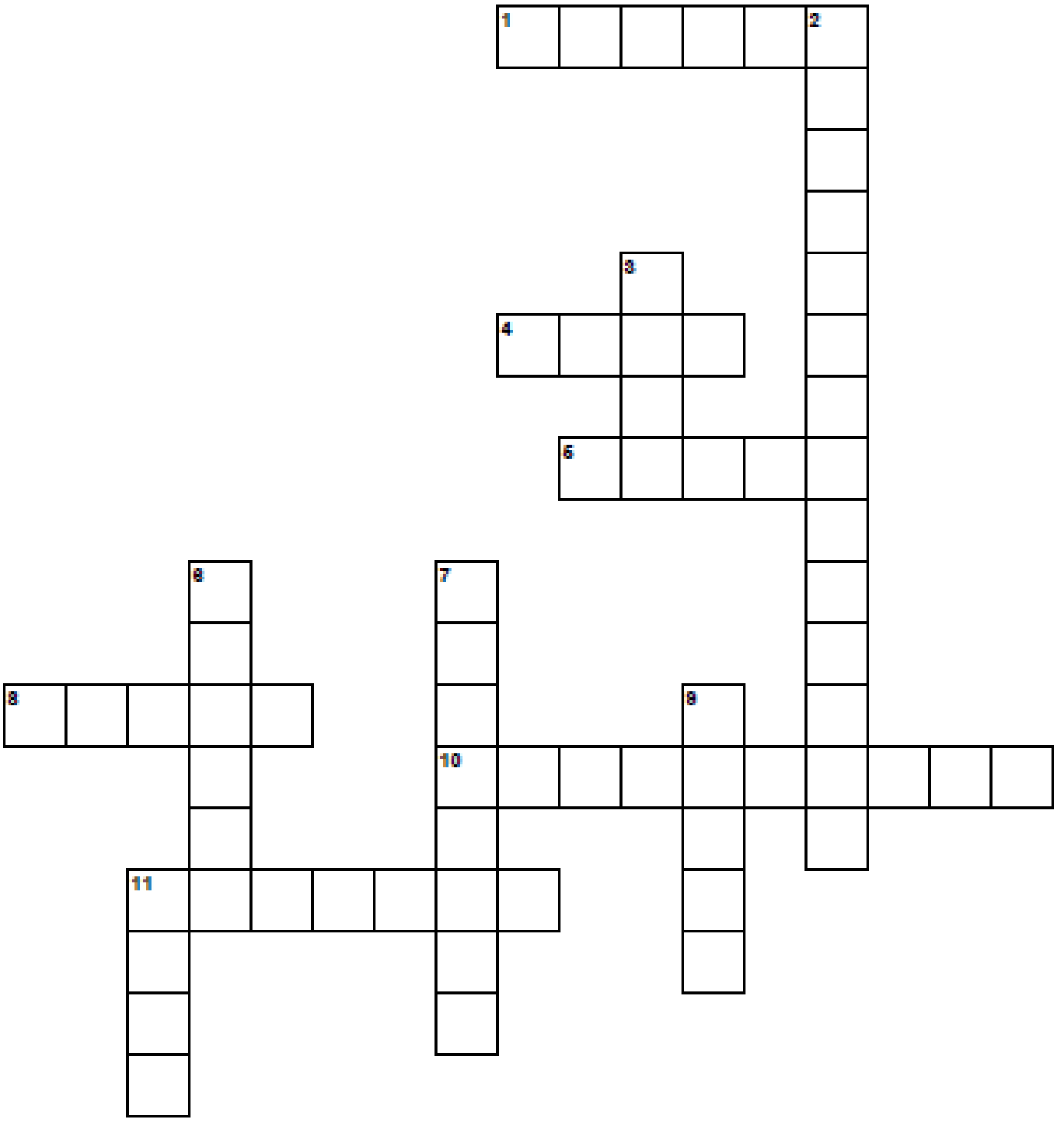
BIO-BASED ACRYLATE RESINS (L)

FORMATION OF NANOCOMPOSITE PHOTOPOLYMERS (R)



THE PLASTIC ALCHEMISTS: TURNING TOXIC TRASH INTO LIFE-SAVING WATER FILTERS

CROSSWORD: ADDITIVE MANUFACTURING



Across

[1] Strain age embrittlement is caused by?
[4] A natural polymer
[5] Alloy of Copper and Zinc
[8] A synthetic polymer
[10] Contains Nickle, Copper, Manganese and Iron. Has very good corrosion resistance
[11] First basic stage of Heat Treatment on metals

Down

[2] Steel with an alloy of Chromium
[3] Grade M is also known by what number?
[6] Alloy of Copper and Tin
[7] Can be used as the body for Hydraulic Jacks
[9] Mixture of two or more elements
[11] A natural fiber produced from leaves of a plant

ASM INTERNATIONAL PUNE CHAPTER

CHAPTER NEWSLETTER

ISSUE NO. 53 | MARCH 2026

MEET THE TEAM BEHIND THE SCREEN!

PROF. YOGESH DANDEKAR (FACULTY ADVISOR, MA CHAPTER CCOEW, NAGPUR)

JASMINE KSHIRSAGAR (NEWSLETTER HEAD)

ARCHINI GHOSH (NEWSLETTER CO-HEAD)

SAMRUDDHI JAISWAL (OUTREACH CO-HEAD)

Help us improve, let us know your thoughts by emailing us at material.advantage@cumminscollege.edu.in

Solution