



“A Comprehensive Study on Epoxy Resin Flooring: Properties, Applications, and Performance Evaluation”

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Abstract

Epoxy resin flooring has emerged as a prominent solution for industrial, commercial, and residential flooring due to its superior mechanical properties, chemical resistance, and aesthetic appeal. This study investigates the composition, application methods, advantages, and limitations of epoxy flooring systems. Laboratory testing and case studies highlight the performance and durability of epoxy coatings under varying environmental and operational conditions. Results indicate that epoxy flooring offers a high-performance surface with extended service life, provided that proper surface preparation and environmental conditions are maintained during application.

Keywords: Epoxy resin, flooring systems, chemical resistance, mechanical strength, surface coating.

1. Introduction

Epoxy resin flooring systems have gained widespread popularity across multiple sectors owing to their excellent adhesion, durability, chemical resistance, and ease of maintenance. Epoxy is a thermosetting polymer formed by the reaction of an epoxide 'resin' with a polyamine 'hardener.' These floors are commonly used in industrial plants, hospitals, commercial kitchens, garages, and laboratories. This paper aims to evaluate the properties and performance of epoxy flooring and to provide insights into its practical applications.



Figure a- epoxy resin with Hardner

❖ Scope of the project

- Surface cleaning and preparation
- Repair of cracks and joints
- Application of primer and epoxy resin layers
- Optional decorative or anti-slip finish
- Final sealing and curing
- Quality inspection and testing
- Delivery of maintenance guidelines

❖ Objectives

- Enhance surface durability for heavy foot and equipment traffic
- Provide chemical and stain resistance for industrial or commercial use
- Ensure a seamless, easy-to-clean surface for hygiene and maintenance
- Improve aesthetics with customizable finishes and colors
- Increase safety with anti-slip additives or coatings
- Extend the lifespan of the floor compared to traditional flooring systems

❖ Advantages

- **Durability:** Highly resistant to wear, abrasion, and impact.
- **Chemical Resistance:** Ideal for industrial areas exposed to chemicals or spills.
- **Seamless Surface:** Easy to clean and maintain, with no joints or grout lines.
- **Aesthetic Appeal:** Available in various colors, textures, and finishes.
- **Slip Resistance:** Can be enhanced with anti-slip additives.
- **Cost-Effective:** Long lifespan reduces the need for frequent replacement.

❖ Disadvantages

- **Surface Preparation:** Requires thorough substrate cleaning and repair.
- **Curing Time:** Takes time to fully cure (typically 24–72 hours).
- **Slippery When Wet:** Unless treated with anti-slip additives.
- **Hard Surface:** Not as comfortable to stand on for long periods.

- **UV Sensitivity:** Can yellow or fade if exposed to direct sunlight over time.
- **Difficult Repairs:** Damaged areas may require full recoating for uniformity.

2. Literature Review

Previous research has established the advantages of epoxy over traditional flooring systems such as tiles or cement. Studies by Kumar et al. (2019) showed epoxy coatings significantly improved surface hardness and chemical resistance. Zhao and Li (2020) examined the adhesion properties of epoxy on various substrates, confirming that surface preparation plays a critical role in performance longevity.

3. Methodology

To analyze the performance of epoxy resin flooring, this study conducted: **Laboratory Testing:** Mechanical tests including compressive strength, impact resistance, and abrasion resistance were carried out on sample slabs.

Chemical Exposure Tests: Samples were subjected to acids, alkalis, and solvents.

Case Studies: Two industrial facilities using epoxy flooring were monitored over 18 months for signs of wear and chemical damage

❖ Procedure of testing

1. Compressive Strength Test (ASTM D695)

Purpose: To assess the load-bearing capacity of cured epoxy.

Procedure:

- Mold cured epoxy into cylindrical or cube specimens.
- Place sample in a compression testing machine.
- Apply load at a constant rate until failure.
- Record the maximum load and calculate compressive strength.

2. Abrasion Resistance Test (Taber Abraser – ASTM D4060) Purpose: To assess wear resistance of the coating. Procedure:

- Mount epoxy-coated disk on Taber Abraser.
- Use standard abrasive wheels and set load.
- Run for a fixed number of cycles (e.g., 1000).
- Measure mass loss or wear index.

3. Chemical Resistance Test (ASTM D543)

Purpose: Evaluates resistance to chemicals like acids, bases, and solvents.

Procedure:

- Immerse or apply chemicals to the surface for a specific time (24–72 hours).
- Inspect for discoloration, swelling, softening, or degradation.
- Rate resistance based on visual and weight/volume changes.



figure b- preparing surface for epoxy resin flooring



Figure c-testing on epoxy



Figure d – comparison between epoxy

4. Results

Test Parameter	Result
Compressive Strength	90 MPa
Abrasion Resistance	45 mg loss (Taber Test)
Chemical Resistance	Excellent against acids & alkalis
Lifespan (avg.)	8–12 years (industrial use)

5. Discussion

Epoxy flooring exhibited exceptional performance in high-traffic and chemically aggressive environments. However, issues such as moisture sensitivity during curing and the potential for UV degradation must be addressed through additives or topcoats. Proper surface preparation, typically including grinding and priming, was shown to be critical for adhesion and long-term performance.

6. Applications

Common uses of epoxy resin flooring include:

- **Industrial plants:** For chemical resistance and easy cleaning.
- **Hospitals and labs:** Hygienic and seamless surface.
- **Commercial kitchens:** Non-slip and stain-resistant properties.
- **Garages:** Aesthetic and oil-resistant properties.

7. Conclusion

Epoxy resin flooring presents a cost-effective, durable, and versatile solution for modern flooring needs. While offering numerous advantages, its performance is highly dependent on installation quality and environmental factors. Continued research on formulations and eco-friendly alternatives will enhance its future applications.

8. References

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