

ADHESIVES

2.1 DEFINITIONS

1. Adhesive

Any substance capable of holding materials together by surface attachment is called an adhesive.

2. Adherends

The materials held together by an adhesive are called adherends.

3. Bonding

The process of holding one material to another by an adhesive is called bonding.

2.1.1 Requisites(or) Quality of an adhesive

It should have,

- high degree of stickiness.
- durability.
- high bond strength after setting.
- rapid bonding ability.

2.2 ADHESIVE ACTION

1. Specific adhesion

- If the attachment of surfaces by an adhesive is due to Chemical (valence) or Physical (Vander Waals) forces of attraction, then this type of adhesion is known as Specific Adhesion.
- During this process, first wetting of the adherend by the adhesive takesplace.
- Then permanent adhesion results, if the interfacial boundary energy of the adhesive and adherend surface is lower than the sum of the surface energies of the adhesive and adherends.

2. Mechanical adhesion

The adhesive may fill the voids of the porous or rough surface and hold them by inter locking action. This type of adhesion is known as Mechanical Adhesion.

3. Fusionadhesion

In some cases, the surfaces get partially dissolved in the adhesive or its solvent and bonding of surfaces takesplace. This type of adhesion is known as Fusion Adhesion.

2.3 FACTORS INFLUENCING ADHESIVE ACTION

- **Surface Energy:** Higher surface energy materials (like metals) tend to have better adhesive properties.
- **Surface Roughness:** Rougher surfaces increase mechanical interlocking, enhancing adhesion.
- **Adhesive Properties:** Viscosity and wetting ability of the adhesive affect how well it spreads and bonds to surfaces.
- **Environmental Conditions:** Temperature and humidity can influence curing times and

adhesion strength.

- **Material Compatibility:** Similar chemical properties between adhesive and substrates promote better bonding.
- **Contamination:** Presence of dirt, oil, or moisture can weaken adhesive bonds.
- **Curing Process:** The method and duration of curing can significantly impact the final bond strength.
- **Technique of application of adhesive:** Flat and non-porous surfaces require very little pressure. But for porous surfaces it is better to keep the joined surfaces together under pressure, so that sufficient bond strength is developed.

2.4 INDUSTRIAL APPLICATIONS OF ADHESIVES

1. Construction

- for laying carpets and floor tiles.
- Adhesives are mixed in the cement and used in joints.
- Interior designers use adhesives to decorate the interiors of buildings. It can be used for sticking wallpapers, bonding panels, fixing dry wall laminations, and in manufacturing prefabricated housing.

2. Ceramic and leather industries

- Ceramic and leather industries normally use.
- use them for bonding leather with dissimilar materials like cotton fiber, nylon, polyester, etc. E.g. cyanoacrylate adhesives
- These adhesives bind rapidly and form a dry, clean, and sturdy bond.

3. Carpentry

- Carpenters rely on adhesives, particularly resins for bonding furniture parts and laminating wood.
- They use adhesives for edge finishing, fixing plywood, finger jointing and flat lamination.

4. Automotive industry

- They are used in motor vehicles ranging from sports cars to heavy trucks.
- These adhesives are capable of holding metal, glass, plastics, rubber, and a variety of fabrics to themselves, to each other, and painted surfaces.
- Adhesives have replaced the mechanical joining methods and have simplified the assembly process.

5. Packaging industry

- Both natural and synthetic glues are used in the packaging industry.
- The paper industry uses water-based and hot melts adhesives for packaging.
- Adhesives are also used for their recycling of paper.

6. Mattresses

There are three types of adhesives used for mattresses.

- Solvent-based mattress adhesives are the most traditional form that provides strong bonds.
- Water-based mattress adhesive is environmentally friendly, flexible, and odorless.
- Hot melt is the newest and most efficient mattress adhesive on the market. It has the fastest curing process and least risks as it involves neither solvents nor water.

7. Photography

- Spray adhesives can be used with foam board, paper, felt, and photo.
- Contact adhesives are used when wood, plastic sheets, and metal are to be bonded.

8. Medical uses

- Adhesives tend to reduce health care costs.
- They reduce the risk of bleeding.
- They significantly reduce the time spent in surgery. Adhesives are being used as an alternative to sutures and staples.
- It saves the patients from the pain while being stitched for external wounds.

9. Office and Stationery use

- Low bonding adhesives are used for office and stationery use.
- These glues can be used on different types of papers like cardboard, poster board, and foamboard.

10. Paint industry

- Adhesives are employed as additives in paint formulations and as primers on glass and metal substrates to improve moisture resistance, reduce the potential of corrosion at the interface, and to promote adhesion.
- Adhesives tend to fill pores, holes, crevices, and micro-voids on the substrate.

