Prepared by
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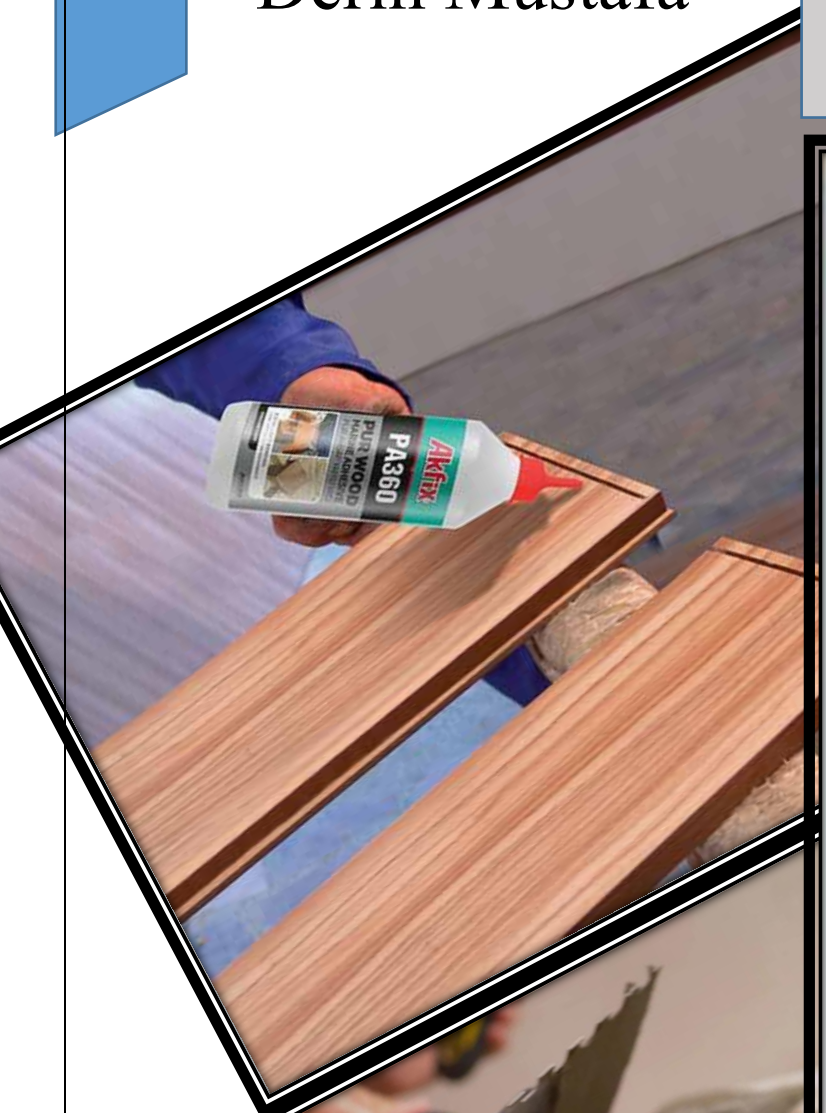
ADHESIVE



Definition

This term can refer both to a property of materials that makes them capable of adhesion (i.e. an adhesive material is able to create a bond with another material) and to any material that is capable of holding two surfaces together by surface attachment (i.e. an adhesive is the substance that is used to create a bond between two materials). Adhesives can also be referred to using the terms “glue”, “cement”, “mucilage”, or “paste”.

Compared to other techniques used to join two surfaces or materials together (e.g. sewing, mechanical fastening, thermal bonding etc), adhesives can be used to join a much wider range of materials together, can distribute stress across the joint more efficiently (reducing the chances of joint failure), offer a more aesthetic design and provide opportunities for greater flexibility of design, and tend to be much more cost effective (and time efficient) than other methods.

There are many, many different types of adhesives, although they are typically categorised in one of two ways. They may be grouped by origin into “natural adhesives” (made from organic sources, such as vegetable starch, natural resins, or animals – sometimes known as “bioadhesives”) and “synthetic adhesives” (made from man-made materials, such as polymers – this group includes emulsion adhesives, thermoplastic adhesives, and thermosetting adhesives).

More commonly, adhesives are grouped by their method of adhesion and then organised into “reactive adhesives” (require a chemical reaction to form an adhesive bond) and “non-reactive adhesives” (don’t require a physical change to form an adhesive bond, although they may undergo a physical change in order to form a bond).

Reactive adhesives are further divided into “multi-part adhesives” (where the chemical reaction takes place between two or more components (usually a base resin and a hardener/curing agent) that are mixed together to create an adhesive bond) and “one-part adhesives” (where the chemical reaction takes place between the adhesive and an external energy source, such as radiation (e.g. UV Light), heat, or moisture).

Examples of non-reactive adhesives include drying adhesives, contact adhesives, hot melt adhesives, and pressure sensitive adhesives. Drying adhesives create an adhesive bond via evaporation and can be either solvent-based adhesives (components of an adhesive are dissolved in a solvent, which evaporates and leaves the components behind) or emulsion adhesives (the components of an

adhesive are dispersed throughout a liquid, such as water, which evaporates and leaves the components behind). Contact adhesives are similar but must be applied to both of the surfaces that are to be stuck together and time allowed for the adhesive to dry (via evaporation), before the two surfaces are pushed together to form an instant adhesive bond. Hot melt adhesives are thermoplastics that are heated and applied in molten form so that an adhesive bond is formed as they cool down and solidify. While other adhesives (sometimes known collectively as "structural adhesives") create an adhesive bond once they have hardened via chemical or physical processes (e.g. via chemical reaction, evaporation, or cooling), pressure sensitive adhesives are "tacky" under normal conditions and require only the pressure of a finger or hand to form an adhesive bond (through intermolecular interactions between the adhesive and the adherend).

DIFFERENT ADHESIVE TYPES

&

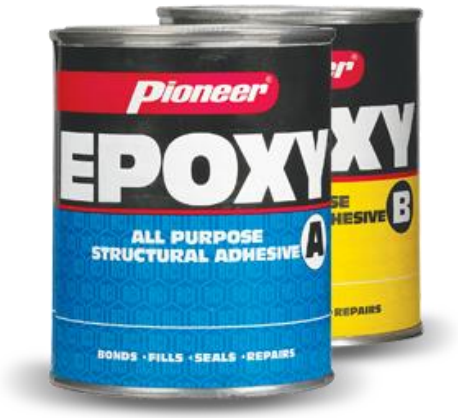
HOW TO USE THEM

ADHESIVES BY CHEMICAL COMPOSITION

Different adhesives can be categorized by their chemistries. Below are a few examples of available chemical compositions.

Epoxy adhesives

Epoxies are a type of structural adhesive. They are highly temperature and solvent resistant and can be structurally bonded to most types of materials, such as metals, ceramics, wood and plastics.



Polyurethane adhesives

Polyurethanes are polymer-based adhesives used for constructions requiring high strength bonding and permanent elasticity. They are often offered as two-part adhesives and have many uses. Unlike epoxy adhesives, they require moisture to set, which means they can be used for projects where other types of glues are often unsuitable.

Polyurethane adhesives, such as the Adbond EX ٥٦٩٠, can be painted for an ideal finish, offer high flexibility and can be used in any weather. This makes polyurethanes ideal for the transport industry.

Polyimide adhesives

Polyimides are one-part synthetic polymers that usually contain solvents. They are known for their strength, heat and chemical resistance, as well as performance in extremely high temperatures, as high as ٥٠٠ degrees Celsius.

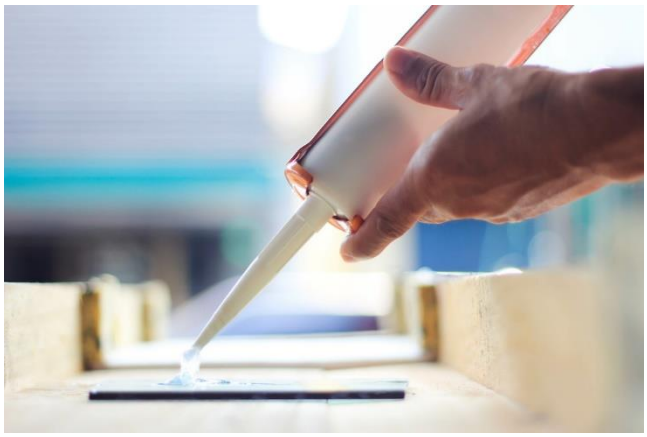
They are offered in two formulations, thermoset and thermoplastic, and are often used for coating or electronic insulation.

ADHESIVES BY PHYSICAL FORM

Adhesive physical form affects product application. Adhesives can be spread manually or using tools and equipment.

Paste

Adhesive pastes are often high in viscosity, thereby making them difficult to spread during the curing period. They are ideal for adhesions requiring gap filling and are usually applied with the use of tools, such as a caulking gun.



Liquid

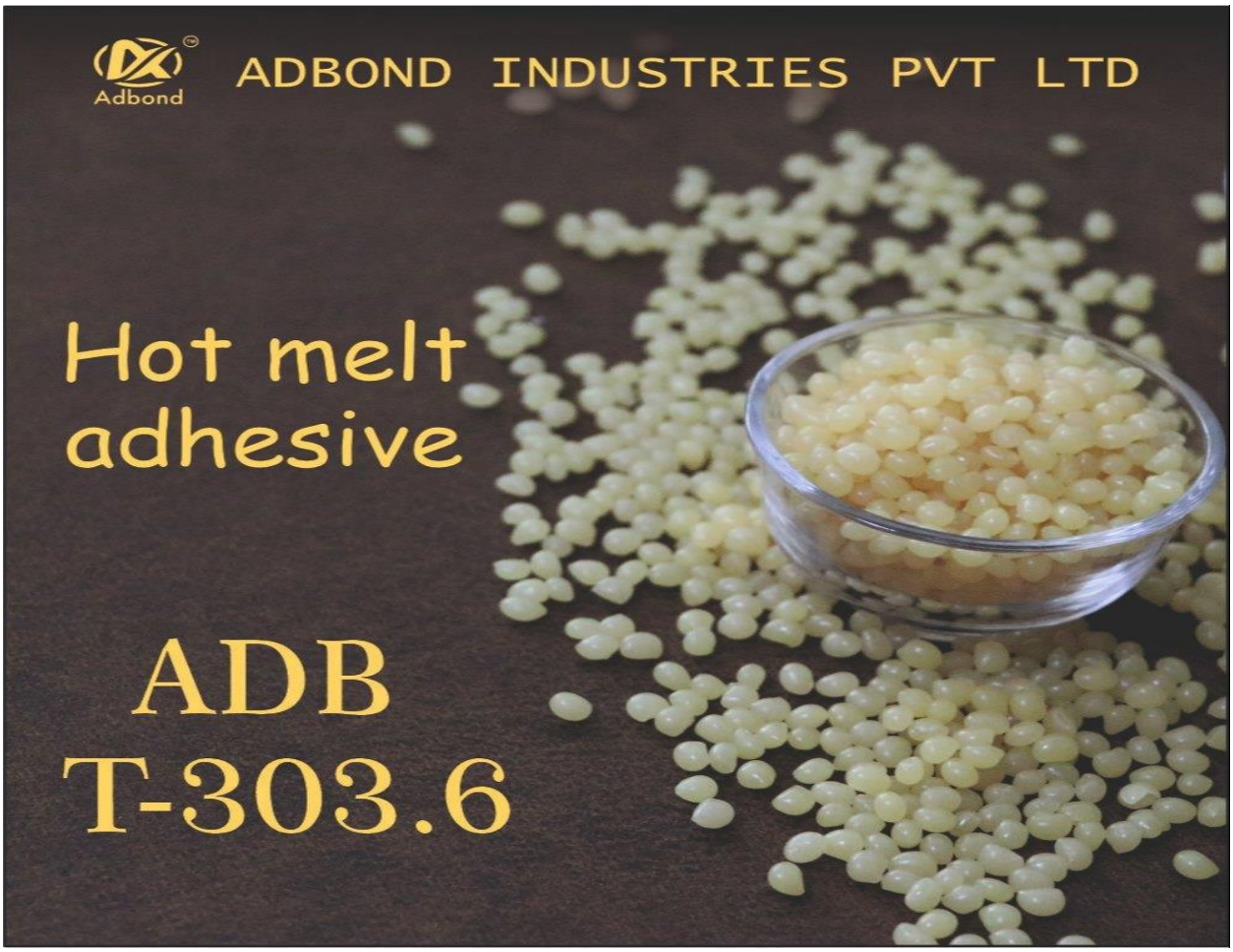
Liquid is the most common form of adhesive. They are one of the easiest to apply but can leak or sag during the curing process. They often take longer to cure but can be applied in thin layers to help this process.

Film

Adhesive films are available in rolls or pre-cut lengths or shapes, provide easy application, and have no pot-life restrictions. They are available in thicknesses between ٢ and ٨ mm for different applications.

Pellets

Adhesives in the form of pellets are typically hot melt or thermosetting adhesives. These must usually be inserted into a hot melt gun or melted and sprayed.



ADHESIVES BY CLASSIFICATION

Adhesives are also classified by structure

Hot melt

Hot melt adhesives are brought to liquid form with heat and can be used to coat entire surfaces before the adhesive cools into a solid polymer. Many industrial sectors appreciate them for their eco-friendliness, safety and shelf life. Different types of hot melt adhesives include EVA-based, APAO-based and those that are pressure-sensitive.

Polyurethane hot melts are also available, but don't have the same properties as standard hot melt adhesives.

Reactive hot melt

Unlike non-reactive hot melt, reactive hot melt adhesives generate additional chemical bonds after the solidification process. This results in stronger adhesion once cured, expanded bonding as well as a higher resistance to moisture, heat and chemicals.

Pressure sensitive

Adhesives in this category are low modulus elastomers, meaning they do not require much pressure to deform and can be used on wet surfaces. They are quite durable for light load applications and are normally purchased as tapes or labels for non-structural applications.

Thermosetting

Thermosetting adhesives are usually available in two-part forms. Resin and Hardener are mixed to obtain a desired setting time. The resin and hardener can be used in one-part form, however these aren't as common because they must be stored in low temperatures. Storing them in high temperatures can cause the desired reaction to occur prematurely, resulting in a much lower shelf life.

Pot life is an important property of thermosetting adhesives. It refers to how long a two-part adhesive will efficiently bond after mixture. A product with a short pot life will harden too quickly, leaving insufficient time to complete the job. Meanwhile, a long pot life can delay setting time and slow the assembly process.

Contact

Contact adhesives are elastomeric and are applied to both items being bonded together. Once the solvent evaporates, the items are brought into direct contact. These types of adhesives are found in rubber cement or countertop laminates.

Adhesive Application Methods

١. Manual:

As the name suggests, in this method, the applicator uses handheld devices and tools to apply adhesives to the surfaces. Manual adhesive application methods can include spraying, web coating, using a brush and a roller, curtain coating etc. Manual application is cost-effective and is recommended for smaller applications.

٢. Glue Applicator:

Glue applicators are handheld devices that assist you to apply adhesives uniformly and at a faster rate than manually. These applicators contain a gun fitted with a cartridge containing the adhesive. A mixing tip is attached to the front of the cartridge to eliminate the need for any manual mixing. These semi-automatic devices enable higher speed, precision and efficiency. Glue applicators are ideal for medium to large-scale applications and are commonly used in the aerospace, electronics and optical industry to fuse small and detailed pieces of equipment.

٣. Automatic Dispensing:

Automatic dispensing is ideal for fast-paced and high-volume environments where consistency and quality finish is crucial. This method is more costly as compared to the above two, however, automatic dispensing can increase efficiency, reduce waste and complete the task at a large scale. Metre-mix-dispense systems are used for two component adhesives and robotic dispensing is used for single component adhesives.

ADHESIVES BY LOAD BEARING CAPABILITY

The load bearing capability of an adhesive indicates how well it can hold different substrates together. They can be separated into three categories.

Structural

Structural adhesives are offered as pastes, liquids and films. They are strong and usually used below their glass transition temperature (Tg), the temperature at which polymer transitions into a soft and rubbery material.

Some well-known structural adhesives are epoxies, cyanoacrylates, urethanes and acrylics.

Non-structural

Non-structural adhesives are used for light loads or in more aesthetic applications. Both non-structural and semi-structural adhesives are much more cost-efficient alternatives to structural adhesives, but they are not suitable for all types of projects. Non-structural adhesives are often used as secondary fasteners in more long-term attachments rather than as a main adhesive.

Semi-structural

Semi-structural adhesives are ideal for less critical applications, though they still offer more strength and support than non-structural adhesives. They can therefore be used to replace either structural or non-structural adhesive applications, depending on the project.

SELECTING THE RIGHT CONCRETE ADHESIVE

If you want to smooth out concrete, fill cracks or gaps, or repair damaged substrates, you need a good concrete repair adhesive, such as a filling compound or repair mortar. Many products are formulated for different layer thicknesses.
For example, use Polybit Polycrete MC for applications between ١٠ and ٢٥٠ mm, while a product like Polybit Polycrete FC is ideal for smaller repairs.

USING CONCRETE ADHESIVE FOR REPAIRS

- **Materials and safety.** Wear gloves and safety glasses when applying concrete adhesives. You need clean water, a mixing container, a mixer, a steel/plastic trowel or sponge, tools to mechanically prepare the substrate, and agents to clean the Concrete (if necessary).
- **Prepare the substrate.** Remove any contaminants or standing water. Prepare the substrate mechanically (e.g. abrasive blasting, wire brushing, grounding, or milling).
- **Reinforcement.** Prepare and treat any reinforcement bars/structures as stated in the TDS.
- **Contact layer.** Moisten the substrate and apply the contact layer according to the product instructions.
- **Prepare mortar.** Using the mixer, mix the contents of the package with water as per the TDS until you have a lump-free mass. Use cold water in warm temperatures.

Once there are no more lumps in your concrete adhesive, you can trowel it onto the substrate.

- **Curing.** The solution usually features rapid drying. You can help the curing process with a non-degradable type of curing compound or wet hessian cloth.

- **Additional protection.** Cover the surface of the project with acrylic paints or flexible insulation layers to protect it against water, aggressive agents, corrosion, and other factors.

Adhesive Applications In Various Industries

١. Bonding:

Bonding is a process in which two surfaces are practically joined together with the help of a suitable adhesive, such as epoxy adhesives. Adhesives are used for bonding materials in various industries, such as electronics, medical, food, optical, chemical and oil and gas industries to bond a range of metals, ceramics, glass, plastics, rubbers and composites.

٢. Sealing:

Unlike bonding which sees two surfaces fused together, sealants are ideal for closing gaps and cavities to block fluids, dust, and dirt from either entering or getting out. Sealants are widely used in aerospace, oil and gas, chemical, electronic, optical, automotive and specialty OEM industries.

٣. Coating:

Coatings are predominantly used in aerospace, electronic conformal coating, along with some other uses in OEM and oil & chemical industries. Industrial adhesive coatings can provide superior protection against chemicals, dust and moisture, reduce friction, improve abrasion resistance and provide EMI/RFI shielding.

٤. Potting:

Potting is an encapsulation method used in the electronics industry to cover small or large electrical components placed inside a housing with a suitable potting material that can withstand high temperatures, protect the circuits from moisture, dirt, dust and other harsh conditions. Potting and encapsulation are used for electronic and microelectronic components, such as sensors, motors, coils, transformers, capacitors, switches, connectors, power supplies, and cable harnesses.

٥. Impregnation:

Impregnation is a method used to wet various fibres, such as glass, carbon, kevlar, aramid among others. Once the fibres are completely saturated with the resin, the resin is allowed to fully cure in place forming a composite substrate. Such impregnated composite surfaces are widely used in the aerospace, windmill and electronics and electrical industries.

CHOOSING THE RIGHT TILE ADHESIVE FOR PORCELAIN TILES

There's a vast selection of tile adhesives on the market, including powdered adhesives and ready mixed pastes. We recommend choosing a powdered adhesive rather than ready mixed adhesives for porcelain tiles. Although application takes a little longer, powdered adhesives create a much stronger bond.

Furthermore, the tile adhesive of choice should be flexible. In areas exposed to damp or humidity, or pressure such as footfall, flexibility is essential. A high quality, flexible porcelain floor tile adhesive will be able to withstand pressure and last longer.

Henkel Polybit offers an extensive range of tile adhesives, including Ceresit CM ١٧, a flexible ceramic and porcelain tile adhesive. This versatile adhesive is suitable for:

- indoor and outdoor application
- wet and dry areas
- floor and wall tiles
- ceramic, porcelain and natural stone tiles

APPLYING HENKEL POLYBIT PORCELAIN TILE ADHESIVE

Ceresit CM ١٧ is a flexible ceramic and porcelain floor tile adhesive. It's also suitable for walls. For best results, work in dry conditions with air and surface temperature between ٥°C and ٤٥°C and follow these steps:

١. **Prepare the substrate.** It should be clean, dry, even and load-bearing. If necessary, level uneven surfaces or remove coatings that could hinder adhesion. If the substrate is absorbent, apply suitable Henkel primer and leave the surface to dry for at least ٢ hours before continuing.

٢. **Prepare the porcelain tile adhesive.** Pour the Ceresit CM ١٧ into a container with a measured amount of clean water. Mix thoroughly with a drill mixer until the liquid is smooth. Wait for ٣ minutes, then mix again.

٣. **Apply the tile adhesive with a notched trowel.** If you're working indoors, the mortar coverage on the back of the tile should be at least ٦٥٪. For outdoor work, use a minimum coverage of ٩٠٪.

٤. **If necessary, remove stains.** Fresh mortar can be removed with water, while hardened stains will need to be removed mechanically.
Once you've finished applying porcelain tile glue, wait at least ١٢ hours before grouting walls and ٢٤ hours before walking on floors.

Wood Adhesive

What Are The Types? Where And How Is It Used?

The usage of the wood materials has improved considerably with the development of the industry and consequently the demand for wood adhesives has also increased accordingly.

Today, there are many types of wood adhesives. Choosing the right product is very important to keep your work smooth and hassle-free. First of all, you should identify your application area and choose the appropriate adhesive for it. There are several types of adhesives commonly used in woodworks. The use of each of these varies based on the properties such as curing time, strength, viscosity and water resistance.

Akfix wood adhesives and glues offer an extensive range of solutions to its users in this regard. These are polyurethane adhesives, silicone-based adhesives, water-based adhesives, cyanoacrylate adhesives and aerosol adhesives.

The ٥ most popular types of wood adhesives and their usage are

١. Polyvinyl Acetate (White Glue, PVA Adhesive, PVA Glue) Wood

Glues are water-based and generally used for the furniture manufacturing. As the surface cleaning is quite important, the old adhesive residues should be cleaned off and the surface should be free of dirt. It requires pressing when applied on vertical environments. **D٢** and **D٣** can be in water resistance classes. As it is water resistant, it is used in high volume adhesion processes such as bonding of decorative papers on the surfaces at the manufacturing of windows, joinery, doors, external door frames, stairs and wood furniture that are water vapor and moisture resistant. In Turkey, white glue is known as framework glue, contact glue, furniture glue, frame glue and water-based wood glue, whereas in the world, it is known as white glue, wood glue, liquid glue, furniture glue, carpenter glue, PVA glue.

٢. Double Component Epoxy Adhesive (E٣٠٠), Epoxy Wood Adhesive;

They are very strong adhesives with high filling properties. They do not require pressing. Epoxies are water-proof and they can be blended with a dry powder with an appropriate color to balance it with the color of the wood. It can be used in both manufacturing and repair works. Although epoxies are very strong adhesives, they should not be used in the rotating and dynamic areas. White glues (D٢,D٣), polyurethane adhesives (٣٦٠FC, PA٣٦٠) should be selected for the rotating and dynamic areas. In Turkey, epoxy adhesives are also known as wood epoxy adhesive, epoxy adhesive for general purpose, water resistant epoxy adhesive, wood ceramic adhesive, syringe adhesive, whereas it is also known in the world as wood epoxy adhesive, rapid wood adhesive, syringe adhesive, waterproof epoxy adhesive, rapid set adhesive.

٣. Super Glue, Cyanocrylates (Rapid Adhesives);

Their most important property is to ensure very strong adhesion in a very short time. They are often used to bond small pieces of wood to each other. They are widely used in minor repair works. Another important feature is that it ensures the pressing process to be more accurate and fast. Since it can also polish the surface, it can be used as a coating on small wooden items. Gel adhesives used with accelerator activators yield faster results. **Akfix ٧٠٥** fast adhesive, consisting of cyanoacrylate gel and accelerator spray, is a life-saver product in case of difficult moments and when you want fast results in short period of time. In Turkey, it is also known as MDF Kit, MDF Adhesive, Mitre Adhesive, Rapid Wood Adhesive, Rapid Co, Rapid Adhesive, Rapid Strong Adhesive, Rapid Marble Adhesive, Double Component adhesive, ٢K Adhesive. It is also known abroad as Fast Adhesive, Fast Glue, Instant Glue, Fast Stick, Stick Fast, Mitre Adhesive, Mitre Glue, ٢K Fast Adhesive etc.

٤. Polyurethane-Based Adhesives; Wood Glue, Marine Glue, Marine Adhesive, Pedestal Adhesive;

They can be used to bond almost any material to wood. (Ceramic, fabric, glass, metal, stone, metal and wood etc.) They are indispensable products in areas continuously exposed to water. They provide very good adhesion and they do not cause any damage especially on greasy and waxed exotic components of wood (mahogany). **Akfix PA٣٧٠** PU wood glue offers high performance solutions in this area. In Turkey, they are known as polyurethane wood glue, polyurethane ship glue, polyurethane sea glue, polyurethane profile glue, marine glue, transparent marine glue, yellow glue, yacht glue, glass fiber sea glue, whereas in the world, they are known as wood glue, pu marine adhesive, aqua seal pu adhesive, multi purpose pu adhesive, rapid pu adhesive, Brown pu glue, wood stone metal adhesive.

٥. Polyurethane Assembly Adhesive;

It is used for assembling components of the cupboards and for bonding of all common building materials (wood, MDF, concrete, metal). It is also known as Liquid Nail. It is suitable for many porous and non-porous surfaces in structures and repairs, where permanent and strong adhesion is required. The best product for this type of repair is **Akfix ٦١٠** Polyurethane Montage Adhesive. It can also be used in places such as kitchens and bathrooms thanks to its waterproof performance.

Even at temperatures up to ٨٠°C bonding strength will not decline.

In Turkey, it is also known as wood adhesive, liquid nail, construction adhesive, Assembly adhesive, cupboard components assembly kit, cupboard assembly silicone, aluminum corner adhesive, elevated floor adhesive. It is known in the world as wood adhesive, no nail, without nail, assembly adhesive, construction adhesive, aluminum corner joint pu adhesive, pedestal adhesive, subfloor pu adhesive and polyurethane adhesive.

WHAT IS THE BEST HEAT RESISTANT GLUE?

When it comes to withstanding high temperatures, not all glues are created equal. General purpose adhesives are not designed to resist temperatures past ٧٠°C. If you need a bond that can withstand high heat, you'll need a heat resistant glue.

Whether you're looking for an adhesive to use in high temperature applications or for a glue that can stand up to repeated exposure to heat, there's a heat resistant glue out there that will suit your needs. We've compiled a list of the best heat resistant glues available, so you can find the perfect one for your project.

WHAT IS HEAT RESISTANT GLUE?

A heat resistant glue is a type of adhesive that can withstand high temperatures. The strongest heat resistant adhesives can resist temperatures of over ٣٠٠°C. Heat resistant glue should be able to bond a range of different materials. These usually include metal, ceramic, rubber and glass. Certain types of adhesive are also effective on plastic materials.

Heat resistant adhesives include cyanoacrylates, epoxies, acrylics, silicone and urethane. Each type has its own unique set of properties that make it more useful for certain tasks. Heat resistant glue is often used in the following applications:

- Ovens, stoves and fireplaces
- Car interiors
- Engines
- Industrial applications
- Joints in exhaust and heating systems

WHAT TO CONSIDER WHEN BUYING HEAT RESISTANT GLUE?

Besides resistance to high temperatures, there are a few other factors you should consider when buying heat resistant glue. Make sure to take into account:

- **Resistance to temperature swings.** Only some heat resistant glues can withstand continuous exposure to high temperatures *and* fluctuations in temperature.
- **Setting and curing time.** These can vary a lot from one glue to another.
- **Viscosity.** High viscosity adhesives are thicker. This makes them better suited for vertical applications, avoiding dripping.
- **Compatibility.** The glue must be suitable for the materials to be bonded.
- **Resistance to shock and vibration.** Indispensable when bonding parts that are subject to movement.

THE ٥ BEST HEAT RESISTANT GLUES

- **J-B Weld ExtremeHeat Paste.** Metallic compound. Formulated to repair iron, steel and other metals. Provides an extremely strong bond and heat resistance of ٥٣٨°C.
- **Rutland High Heat Silicone.** Silicone adhesive. It will form a tough, flexible seal in addition to strong adherence. It will even seal out gas and smoke. Adheres to most surfaces and provides heat resistance up to ٢٦٠°C.
- **Loctite Stik ‘n Seal Extreme Conditions.** Silane-modified polymer adhesive. Effective on a wide range of materials, including many hard-to-bond plastics. Resists weather, vibrations, moisture, UV and temperature swings. Operating temperature ranges between -٤٠°C and ١٢٠°C.
- **Permatex High Heat Epoxy.** Two-part epoxy. A strong adhesive that seals against liquid, gas and motor oil. Ideal for automotive applications. Provides heat resistance up to ٢٦٠°C.
- **DAP High Heat Mortar Fire Stop Caulk.** Silicate cement. The best product for fireplaces and stoves. Extremely tough. It blocks smoke and fire and resists temperatures up to ١٠٩٠°C.

Conro Electronics is a leading supplier of materials and tools in the electronic manufacturing industry.

Heat Resistant Adhesives

- Temperature Resistance
- Differential Thermal Expansion
- Thermal Cycle – Thermal Shock

Why are some adhesives listed as high temperature resistant when they resist only ١٥٠°C, while others are classified as high temperature resistant and resist ٣٠٠°C or more? The classifications are based on what typical temperature resistance is for that technology. For example, a standard anaerobic threadlocker resists ١٥٠°C, so a threadlocker that resists ٢٣٠°C is a high-temperature resistant threadlocker. At the same time, standard ethyl-based cyanoacrylates resist ٨٢ °C, whereas some specialty grades can withstand ٢٥٠°C.

Organic adhesives such as cyanoacrylate, epoxy, acrylic, anaerobic, and UV curable acrylates will break down around ٢٥٠, and ٣٠٠°C. Where inorganic-based adhesives such as ceramic threadlockers can resist up to ٦٥٠°C and silicone based can exceed ٣٥٠°C.

Differential Thermal Expansion

The ability of the adhesive itself to resist breakdown due to high temperature is only one facet of a complex set of conditions. Adhesives can soften as temperature increases. This can be an added benefit as they absorb stresses related to differential coefficients of expansion and contraction. However, when designing with heat-resistant adhesives for high-temperature applications, it is best to test the joint strength at the required temperature. This is often listed as Hot Strength.

Service Temperature

The service temperature listed for the adhesive is a guide. The factors affecting the actual service temperature of anyone bonded joint include:

- Adhesion to the substrates
- Bond area
- Speed of the temperature change
- Amount of load or stress on the joint,
- Gap filled with the adhesive
- Coefficients of expansion of the two substrates
- Length of time at high temperature

Most heat resistant adhesives can resist higher temperatures than what is listed as the service temperature for short periods of time, providing adhesion to the substrate is high and the stress is low.

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