

ThreeBond

TECHNICAL NEWS

Three Bond Technical News
Issued March, 1991

10

INSTANT ADHESIVE (Cyanoacrylate-based)

Introduction

Instant Adhesives (cyanoacrylate-based) sets instantly at room temperature, has powerful adhesive strength, has only one easy-to-use component, and contains no dangerous solvents.

Development of the adhesive began in 1949 by Alan E. Ardis of Goodrich Corporation in the US. Then in 1959 it was introduced into the market by FB Joyner and GF Hawkins of Eastman Corporation as Eastman 910.

Later improvements and modifications of the synthetic method of the major-ingredient monomer were performed by the leading adhesive manufacturers. The Eastman 910 became quite popular for both industrial and home use because of its superior features.

This report explains the reaction mechanism and advantages as well as disadvantages of instant adhesives and introduces Three Bond 1700 series products and future trends of instant adhesives.

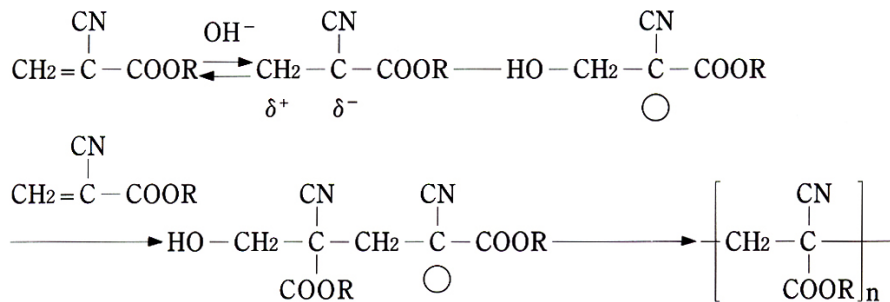
Contents

Introduction	
1. Reaction mechanism	1
2. Three Bond Instant Adhesives (TB1700 series).....	1, 2
2-1 Classification of Three Bond 1700 series	
2-2 Features of Three Bond 1700 series	
3. Advantages and disadvantages of Instant Adhesives.....	2
4. Major application examples of Instant Adhesives	3
5. Three Bond 1797 Primer for Instant Adhesives for difficult-to-adhere materials	3,4,5
5-1 Outline	
5-2 Features	
5-3 Properties	
5-4 Functions	
6. Three Bond 1739: Gel type Instant Adhesive	6
6-1 Outline	
6-2 Properties and basic performance	
6-3 Performance	
Postscript	

1.Reaction Mechanism

The setting reaction mechanism for instant adhesive is anion polymerization. It is quick reacting because a substance having anions causes polymerization and setting within seconds. Typical substances which have these anions are

water (H·OH), methanol (CH₃OH), caustic soda (NaOH), etc. OH is the molecular structure which acts on cyanoacrylate and polymerizes and sets the resin by the process shown in figure below.



Where R: Methyl radical (-CH₃), ethyl radical (-C₂H₅)...Alkyl radical, etc.

2.Three Bond Instant Adhesives (TB1700 series)

2-1 Classification of Three Bond 1700 series

Classification	Purpose	TB Grade	Viscosity (cP)	Remarks
Three Bond 1700 series		1701	3	Methyl cyanoacrylate
		1702	35	Adhesion of metal, rubber, and plastics
		1703	100	
	For general adhesive use	1741	2	Ethyl cyanoacrylate
		1743	100	Adhesion of metal, rubber and plastics
		1745	500	
		1747	2,000	
		1713	100	Slow-setting type
	For heat resistance	1751	3	Excellent heat resistance
		1753	80	
	For impact resistance	1781	3	Excellent release strength and impact resistance
		1782	80	
		1783	1,000	
	For carpentry	1785B	3	For adhesion of porous bonded material such as wood
		1786	150	
1787		1,100		
For low odor, low whitening use	1721	10	Low-odor, low whitening property	
Gel type	1739	Gel	Gel, ideal for ceiling and perpendicular surfaces	
Releasing agent	1795	1	For clean, whitened or protruding areas	
Hardening promoter	1796	1	For hardening thick-coated areas of padded part, etc.	
Primer for difficult-to-adhere Materials	1797	1	Adhesion of PE and PP is possible with instant adhesives	

* Besides the above standard product, special products are available with various viscosity, colors, etc.

2-2 Features of Three Bond 1700 series

Three Bond 1700 series has the following outstanding features:

1. Adheres instantly. Usually within only 5 seconds to 3 minutes.
2. Easy-to-use; no training required. It is a single component solution therefore no mixing required. Also no pressurizing or heating required.
3. Adheres powerfully at room temperature.
4. Adheres by using a very small quantity. Low viscosity and excellent elongation easily spreads to corners. Consumption is half that of other adhesives.
5. The finish of bonds areas remain neat, colorless and transparent.
6. Contraction during setting is practically nil.
7. Speeds up assembly time and improves productivity.

3. Advantages and Disadvantages of Instant Adhesives

90% of Instant Adhesives currently used for general purposes is ethyl cyanoacrylate and the rest is methyl

cyanoacrylate. The advantages and disadvantages of these two types of instant adhesives are enumerated below.

Advantages	Disadvantages
1) Instant adhesive property	1) Inferior heat resistance
2) Room temperature setting type	2) Inferior impact resistance
3) One-solution, non-catalyst type	3) Inferior pliability
4) High adhesive strength	4) Only for small clearances
5) Excellent electric insulation	5) Will not adhere a large area in one stroke
6) Excellent chemical resistance	6) Irritating odor and whitening
7) Small consumption	7) Adheres easily to skin; requires careful handling.
	8) Careful storage control required



Three Bond 1739 Instant Adhesive Gel

4. Major Application Examples of Instant Adhesives

Usage examples from various industries are shown below

Industry	Parts	Bonded material
Electrical machinery and equipment	Tape recorder pushbutton Iron pushbutton Player pushbutton Rod antenna ornament Capstan Magnetic head Fuse casing Computer TV CRT tube package Rubber cushion for washing machine	ABS + chrome metal fittings Duracon + aluminum Zinc + brass ABS + chrome-plating Brass + stainless steel Parmaloy + iron Polyester + polycarbonate Urethane rubber + polyacetal Neoprene + neoprene Neoprene + ABS Neoprene + SBR
Automotive	Plug code cover Dashboard dresser Braid edge Door handle parts Distributor packing Window-frame rubber Cushion absorber Washer nozzle Mud guard Tail lamp edge ornament	Neoprene + soft PVC Foam urethane + soft PVC Soft PVC + soft PVC Neoprene + unichrome plating Neoprene + phenol EPT + EPT Neoprene + unichrome-plating Neoprene + ABS Natural rubber + natural rubber Neoprene + chrome-plating
Precision machinery and equipment	Camera finder Printed wiring Camera shutter Camera tripod Strain gauge Sawing-machine parts	Glass + iron ABS + aluminum Stainless + aluminum ABS + aluminum Polymide + iron ABS + SPC copper
Musical instruments	Piano keys Guitar bridge Banjo drum Piano action parts Flute	ABS + aluminum Posewood + urethane coated board ABS + plywood Maple + maple ABS + chrome-plating
Others	Hume pipe packing rubber Sphygmomanometer Rupture disk of fire extinguisher Carrier wheel Rubber mat fastener Injection needle Writing pen Doll	Synthetic rubber + synthetic rubber Neoprene + neoprene Polyester + synthetic rubber Neoprene + zinc Synthetic rubber + nylon Stainless + PVC Polyacetal + gold-plating Soft PVC + soft PVC

5. Three Bond 1797 Instant Adhesive Primer –For difficult-to-adhere materials

Even in the advanced state of present chemistry no adhesive has been yet developed which securely adheres polyethylene, polypropylene and fluoro-carbon resin.

Bonding these difficult-to-adhere materials requires acid, heat or radiation treatment to the materials to activate the resin.

But all these methods are dangerous, require equipment and are very complicated processes to the point of impracticality. We introduce here a primer which has no such disadvantages but helps to securely bond difficult-to-adhere materials.

5-1 Outline

Three Bond 1797 is an exclusive use primer to strongly adhere difficult-to-adhere materials such as polypropylene, polyethylene, polyacetal, EPT rubber, etc., then followed by Three Bond 1700 series (instant adhesive).

In the past pretreatment for polypropylene, polyethylene, etc. required strong acid alkali and heat for satisfactory adhesion. But the operation was troublesome and time consuming. Further, safeguards necessary to protect against human exposure made it impractical to use. At that time, Three Bond 1797 was developed to make pretreatment easier and improved room temperature adhesion.

5-2 Features

1. Three Bond 1797 has excellent adhesion on polypropylene, polyethylene and polyacetal. Also on EPT rubber, polyurethane and soft PVC.
2. Dries quickly at room temperature so assembly can be performed immediately after coating.
3. Shortens set time.
4. There is a Three Bond 1700 series product to meet any instant adhesive need.

5-3 Properties

Item	Product Name	Three Bond 1797
External appearance		Light yellow liquid
Viscosity		0.85
Specific gravity		0.80
Major ingredient		Amine-based promotor

5-4 Functions

a. Set Time (Same and different materials) (second)

Material	Polypropylene	Polyethylene	Polyacetal	Iron
Polypropylene	5	5	5	10
Polyethylene	-	5	5	10
Polyacetal	-	-	5	10
Iron	-	-	-	15

b. Shear Strength (kgf/cm²)

Material	Polypropylene	Polyethylene	Polyacetal	Iron
Polypropylene	45.6*	39.0*	49.6*	28.1
Polyethylene	-	33.0	36.5	21.5
Polyacetal	-	-	47.1	31.2
Iron	-	-	-	130.5

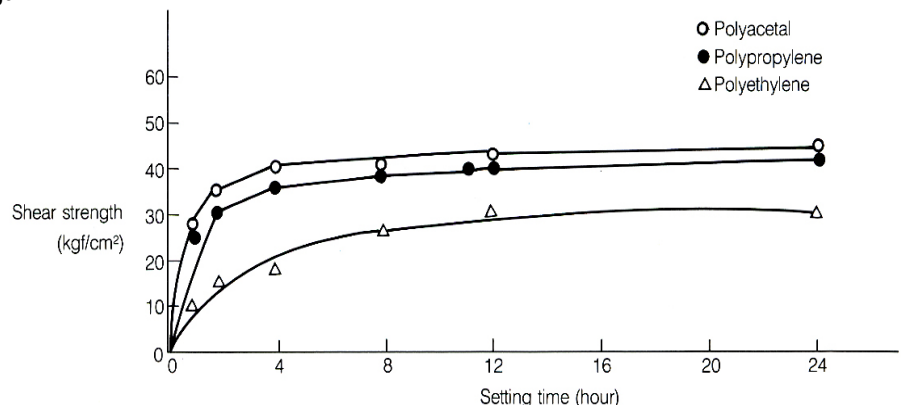
* Material destruction 25°C×24 hr setting

c. Setting Time and Shear Strength (kgf/cm²)

Material	Time (hour)	1	2	4	8	12	24	72
Polypropylene		25.1	30.4*	35.3*	38.7*	41.4*	45.6*	46.0*
Polyethylene		11.1	17.0	20.0	27.2	33.0	32.5	33.0
Polyacetal		28.1	36.2	40.2*	41.5*	45.2*	47.1*	46.2*

* Material destruction 25°C setting

Setting Time and Shear Strength



d. Three Bond 1797

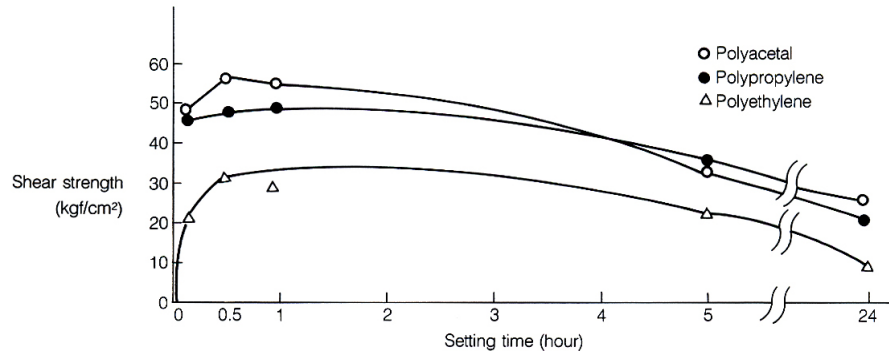
After coating standing time and shear strength

(kgf/cm²)

Material \ Time (hour)	Immediately after coating	0.5	1	5	24
Polypropylene	45.6*	48.4*	49.4*	35.2*	21.3*
Polyethylene	21.5	31.6	30.0	21.0	10.6
Polyacetal	47.1*	56.7*	55.0	34.7	24.8

*Material destruction 25°C×24 hour setting

After coating standing time and shear strength



e. Coated quantity and shear strength

(kgf/cm²)

Material \ Distribution method	A	B	C	D	E
Polypropylene	24.1	27.3	37.3*	42.1*	46.0*
Polyethylene	16.4	19.8	32.3	39.4	42.1
Polyacetal	61.0*	58.2*	49.4*	45.2*	14.2

*Material destruction 25°C×24 hour setting

Coating method

- A: One time wiping cloth
Immersed in Three Bond 1797
- B: Two-time wiping cloth
Immersed in Three Bond 1797
- C: Three-time wiping cloth
Immersed in Three Bond 1797
- D: Four-time wiping cloth
Immersed in Three Bond 1797
- E: Dipping in Three Bond 1797

Coated quantity is large

f. Heat Resistance Test Shear Strength Test

Leave standing at 80°C; setting at room temperature (kgf/cm²)

Material \ Time (hour)	1	4	8	12	24
Polypropylene	42.1*	41.3*	47.6*	52.1*	47.2*
Polyethylene	39.1	40.2	42.2*	42.1*	41.3
Polyacetal	48.2*	56.1*	55.3*	48.6*	48.0*

*Material destruction 25°C×24 hour setting

Peeling test

Material	Peeling strength
Polypropylene	3.5*
Polyethylene	1.4*

g. Usage

- Wipe and clean surfaces with a solvent, etc.
- Use cloth or a brush immersed in Three Bond 1797; wipe contact surfaces once or twice. After drying, bond the surfaces with Three Bond 1700 series.
- When bonding difficult-to-adhere materials such as polyethylene and polypropylene to easy-to-adhere materials such as iron and copper, coat the difficult-to-adhere material with adhesive.
- If the coated quantity of Three Bond 1797 is too much or too little, adhesive force drops.
- The effect of coated Three Bond 1797 lasts for about one hour.

6. Three Bond 1739 Gel-type Instant Adhesives

6-1 Outline

Three Bond 1739 is a new instant adhesive with gel consistency.

The performance level of Three Bond 1739 is the same as liquid-type instant adhesives. But its thixotropic property allows use on perpendicular surface and ceiling. When used with a hardening agent, concave surfaces can also be filled.

6-2 Properties and Basic Performance

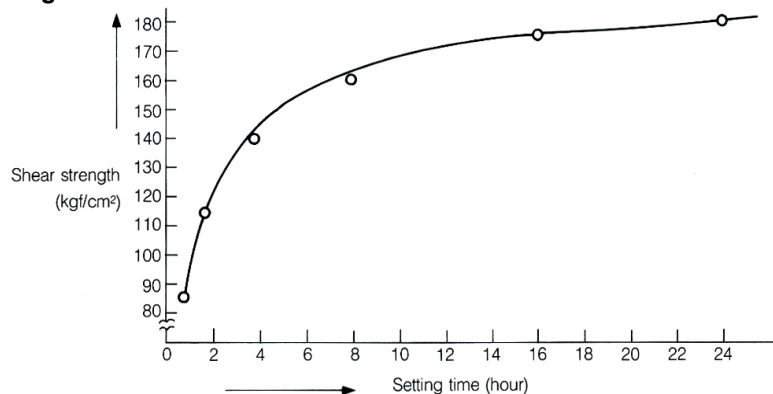
Test Items		
Appearance		Colorless transparent liquid
Viscosity		23,000 cP
Thixotropic ratio		3.5
Specific gravity		1.03
Set time	NBR	35 ~ 40 sec.
Set time	Iron/Iron	30 ~ 35 sec.
Shear strength	Iron/Iron	180kgf/cm ²

6-3 Performance

a. Standing time and Adhesive Force (RT: shear strength)

Leave standing	1h	2	4	8	16	24
Strength	85	115	143	162	178	180

Setting the Time × adhesive strength



b. Shear strength and set time classified by material

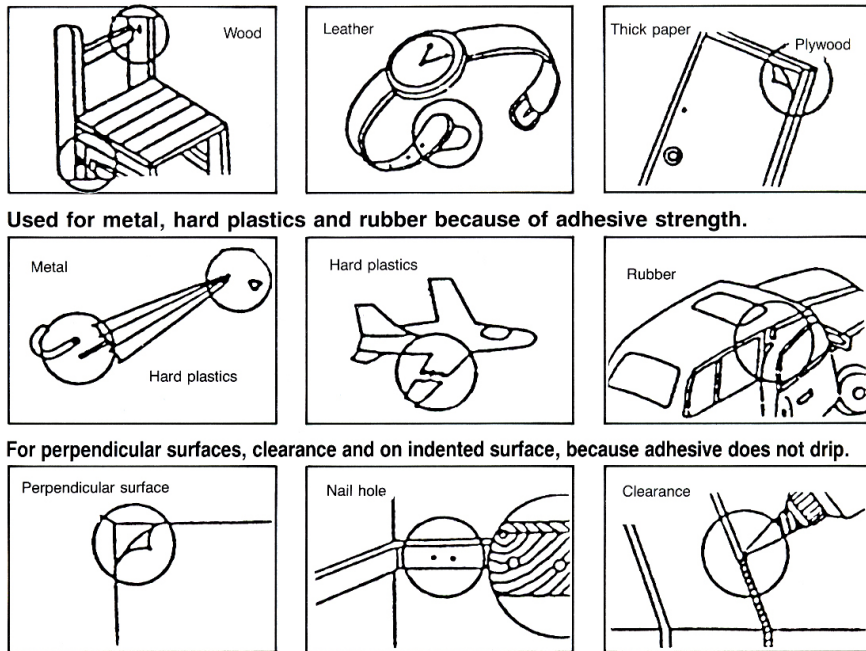
Material	Set time (second)	Shear strength (kgf/cm ²)
Iron - Iron	30 ~ 35	180
SUS - SUS	45 ~ 50	150
Aluminum - Aluminum	20 ~ 30	130
Copper - Copper	10 ~ 15	165
Glass - Glass	10 ~ 15	*
Hard PVC - Hard PVC	20 ~ 25	80 [*]
Polycarbonate - Polycarbonate	20 ~ 25	70 [*]
Nylon - Nylon	20 ~ 25	65 [*]
Natural rubber - Natural rubber	30 ~ 35	*
NBR - NBR	35 ~ 40	*
EPT - EPT	35 ~ 40	*

*Material destruction

c. Purposes

- (1) To fix parts and lead wires in printed circuit boards
- (2) Bonds and repairs automotive and machine parts
- (3) Bonds water and paper products
- (4) For hobby use such as plastic models
- (5) Fills and bonds if used with setting agent

Example Of Use



Used for metal, hard plastics and rubber because of adhesive strength.

For perpendicular surfaces, clearance and on indented surface, because adhesive does not drip.

■ Postscript ■

Instant adhesives easily and quickly adhere because of their structure and reactivity. At present, they cannot be used for structural (mono-structural) applications because relative to epoxy resin and alkyl resin adhesives instant adhesives have weaker impact and heat resistance. However, by using a new radical in the molecular structure of instant adhesives and by combining with elastomer, future instant adhesives may have these shortcomings resolved and become marketable.

Improvements in instant adhesives will permit instructions of new applications in electric and electronic fields with such features as conductive property and improved operational environment with lower odor and lower whitening. These adhesives will become increasingly important in the near future.

Atsushi Okuma
Adhesive Research Team, Research Institute

Easy, No Waste, Clean Adhesion Instant Adhesive Automatic Coater

Even an excellent product cannot achieve excellent results unless the application technique is equally good. To use good products skillfully yields higher productivity, higher quality and lower costs. Three Bond has developed instant adhesive automatic coaters, requiring no special training and are highly praised by users.

■ Fan-flow N100

Insert a tube into a container filled with adhesive and lightly press the pushbutton on the pen shaped nozzle to discharge adhesive. The coater requires no air source and operates only on electricity. Since it is a tube type, it can supply precise quantity continuously.

■ TB Coater S

First the adhesive container is placed into the tank then pneumatic pressure feeds the adhesive. Lightly press the pushbutton on the pen shaped nozzle to discharge adhesive. Micro-adjustment of the discharged quantity is easily made. Since there is no error, it prevents wasting adhesive. The coater can be used not only for manual production, but also can be easily installed on-line with proper modifications.



Three Bond Co., Ltd.

1456 Hazama-cho, Hachioji-shi, Tokyo, 193 Japan
Phone:(0426)61-1333 Fax:(0426)62-2754