CTECH Adhesives LLC

Chemical and Process Solutions for the Specialty Coatings & Adhesives Industry

CTECH™ UV Curable Pressure Sensitive Adhesives Series.
CTECH Product No. 10-201-1A UV PSA

Product Data Sheet.

Product Description.
CTECH™ UV-PSA series are patent pending, 100% solids UV curable products that can be used to bond together many different types of substrates; including almost all plastics, metals and ceramics. With this proprietary technology the rapid processing advantages of UV curing can now be used with opaque and difficult to bond substrates. The materials cure immediately with UV exposure to crystal clear pressure sensitive films, coatings, beads and bondlines.

CTECH 10-201-1A exhibits a superb combination of peel, tack, static shear and aging properties with industry leading process latitude in application techniques and UV curing. For example a matrix of films between 0.5-3.0 mils thick cured with UV doses of 0.5-1.5 J/cm2 all achieve comparable peel and static shear values.

This adhesive can be applied to substrates by screen printing films and designs; valve and syringe dispensing for dots, beads and gaskets; as well as by transfer/gravure rollers for large scale laminating uses. A variety of UV systems can be used for curing including flat bed "UV ink driers"; microwave and electrode initiated lamps with mercury or doped bulbs.

This product is just one of an extensive line available in the CTECH laboratories with a range of viscosity from inkjet printable to gels and cured properties spanning the limits of tack, peel, adhesion and modulus. Please contact CTECH LLC for your specific needs.

Typical Physical Properties.
Uncured Material.

Color: Straw color with distinctive odor. (bleaches clear upon curing)

Shelf Life: Twelve months at ambient. Protect from light. Flash Point: > 100^{o} F.

Viscosity, nominal: CTECH 10-201-1A is 2,250 cps.

% Non-Volatile Material: 99+ % Specific Gravity: 1.19 g/ml

VOC During Cure – the products lose less than 0.1% by weight when UV cured as films.

Solubility: acetone, MEK, isopropanol, toluene, ethyl acetate and similar solvents.

Features and Benefits.

- Solvent-free, 100% solids formulation
- Long shelf life un-cured
- UV curable for instant processing
- Use any application method
- Superb process latitude
- Reusable for low waste
- Long shelf life of cured films
- Immediate assembly of parts
- Films/beads from 0.1 – 20 mils
- Unsurpassed combination of peel and creep resistance
- Sensitive to visible wavelengths for curing through UV blocked / translucent substrates
- Cures to crystal clear, optically transparent PSA that maintains clarity for years

Uses and applications.

- Sign making and other graphic assembly
- Touch pad, membrane pad, other keypads
- Automotive interiors – trim, graphics, light panels
- Lamination of foam, foils, any plastic film, felt, mesh etc
- Form-in-place gaskets and O-rings
  -replace die cut forms
  -replace press-fit, snap-fit tabs on parts for lower cost molded parts
- Traditional tapes and films replacing solvent and water carried PSAs

Process and Performance Summary.

CTECH 10-201-1A UV PSA at 0.5 - 3.0 mil thickness. Application by screen print, hand brushing, draw down techniques.

- *Any type of lamp can be used - total dose should be around 1J/cm2.*
  - *Heating of the substrate by the lamp will govern the exposure time / belt speed; bulbs need to be backed away from the substrates so that conveyors can be run slower and the full dose achieved without overheating.*
  - ***The most practical lamp system is an unfocused "iron doped mercury bulb" with adjustable height.***
    - *This system allows a huge tolerance in dose and film thickness with the CTECH 10-201-1A for optimum manufacturing latitude.*
- *After UV cure:*
  - *Immediate peel values are very good for instant assembly*
  - *24 hour peel values rise considerably and remain stable over long periods – many months to years.*
  - ***Optimum static shear values [creep resistance] are achieved after 5 days aging at ambient temperature. [assembled or as film]***

- *Instant creep values are similar to emulsion acrylic PSAs - after aging 10-201-1A passes many weeks of testing at ambient and at 50C - the specification is 10 days.*

Processing.

- Use as is without dilution
- Stirring is not required
- Be aware of ambient lighting – sunlight through windows and from industrial mercury lighting may cause premature gelling / curing. Standard fluorescent lighting will not affect the product for many hours.
- Uncured product can be reused
- Product can be left on screens, in hoses, in valves for a couple of days if not exposed to light.
- Use plastic, non-magnetic steel components. Avoid brass, copper, iron etc.

Screen Printing Details.

Standard screen materials and equipment can be used safely with the 10-201-1A formulation. A mesh of 75 tpi creates a 1-mil film and ranges of 50-120 tpi will deposit about 2-mil and 0.5-mil respectively. These are nominal values and depend on squeegee type, force, angle etc. as well as other printing variables.

Curing.

CTECH 10-201-1A can be cured with almost any UV lamp or bulb regardless of intensity or wavelength. While the product is sensitive to wavelengths between 200-420 nm., the reported intensity and dosage values are measured with radiometers centered at 365 nm. The target exposure dose to begin testing films in the range of 0.5 – 3.0 mils thick is about 1 J/cm2. This may be 1 second under a very high intensity bulb of 1 W/cm2 or it may be 40-50 seconds at 0.02 W/cm2.

The product has such extremely good latitude that it is important to find conditions where it is *not* cured properly. Undercure is more of a concern than overcure. To establish a curing process a matrix of film, bead thickness or weight of +-100% and a UV dose of +-50% should be created. Testing immediately after cooling establishes protocol for on-line QC once the system is on the manufacturing floor. The adhesive undergoes significant post-cure over 24 hours before stabilizing at much higher values. Undercuring parameters will become obvious, as the post-cure does not occur.

UV Fixture Time.

The material is pressed between two glass microscope slides and exposed to 20 mW/cm^2 of UV light until the slides are “fixed” or cannot be moved. **4 seconds**.

Peel Test.
These products are relatively low tack materials after UV. The immediate peel strengths are 1-4 pounds per linear inch [pli], rising to 8-12 pli after 12 hours. Final peel values are the same regardless of dwell after UV exposure.

Peel adhesion is evaluated according to the Pressure Sensitive Tape Council Method Number 1 (PSTM 1). Adhesive is applied to Mylar film and cured for 1 J/cm2 of UV light. These strips are then placed on top of 1-inch wide steel laps and rolled with a 4.5-pound weighting. Peel strength is tested 30 seconds and >12 hours after lamination and is reported as the continuous value in pounds to maintain a 90-degree peel.

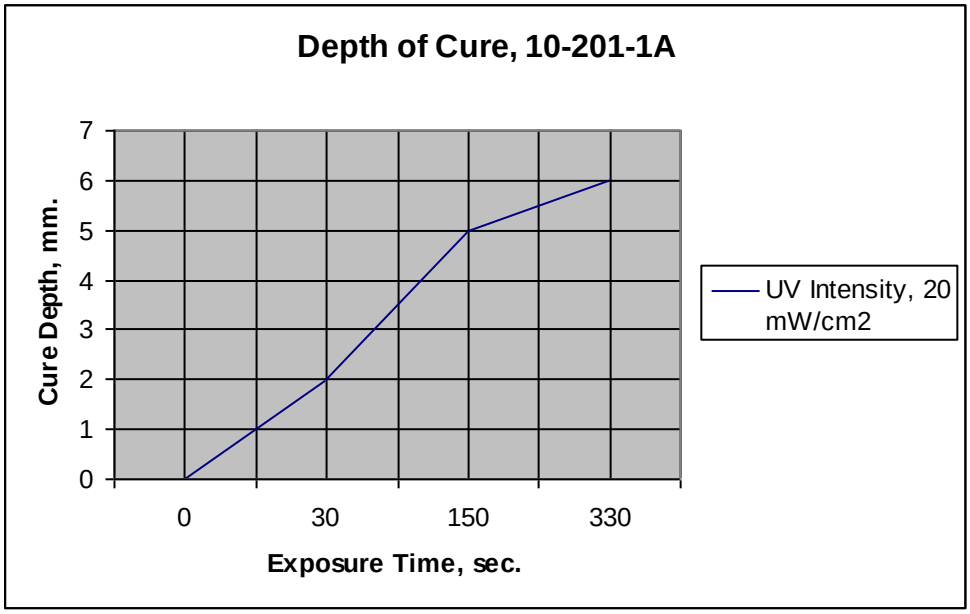
UV Cure and Timeline Latitude for CTECH 10-201-1A. Fusion Systems 300WPI lamp- "D"(doped) bulb at 4 inches. 3-mil PET to untreated steel

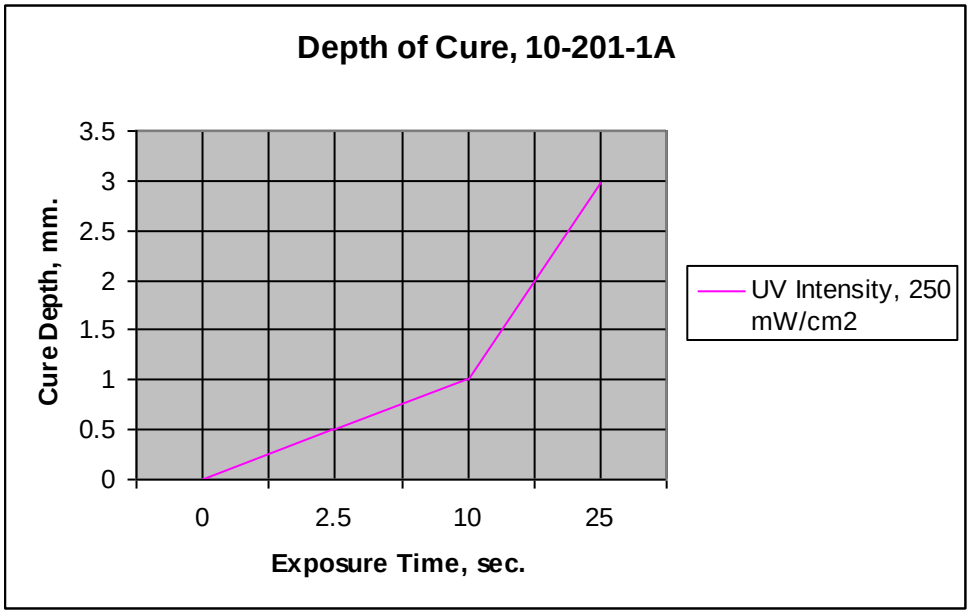
Age of uncured adhesive	Age of cured Film	Nominal Thickness – mil	UV Dose – J/cm2	30 second peel – pound per linear inch – pli	12+ hour peel - pli
2 years	2 months	0.5	0.5	2-4	8
2 months	2 years	0.5	1.0	1-2	8
2 years	2 months	0.5	1.5	2	8
2 years	2 months	3.0	0.5	4	8
8 months	2 days	3.0	0.8	3	10-12
2 months	2 days	3.0	1.5	2	10-12

NOTE: All of these test pieces passed >10 days of creep resistance at ambient and 50C.

Depth of Cure.

The depth that has solidified after UV exposure. Note the effect of intensity – lower intensity and longer times cure much deeper.





Performance of Cured Product.

Peel Force to Various Substrates. PSTM1 Test., 3-mil adhesive on PET film, Cured at 1.2 J/cm2 with Fusion System D bulb. Assembled and then tested at 24 hours. 90° peel test [Convert to N/10 mm by multiplying by 1.75]

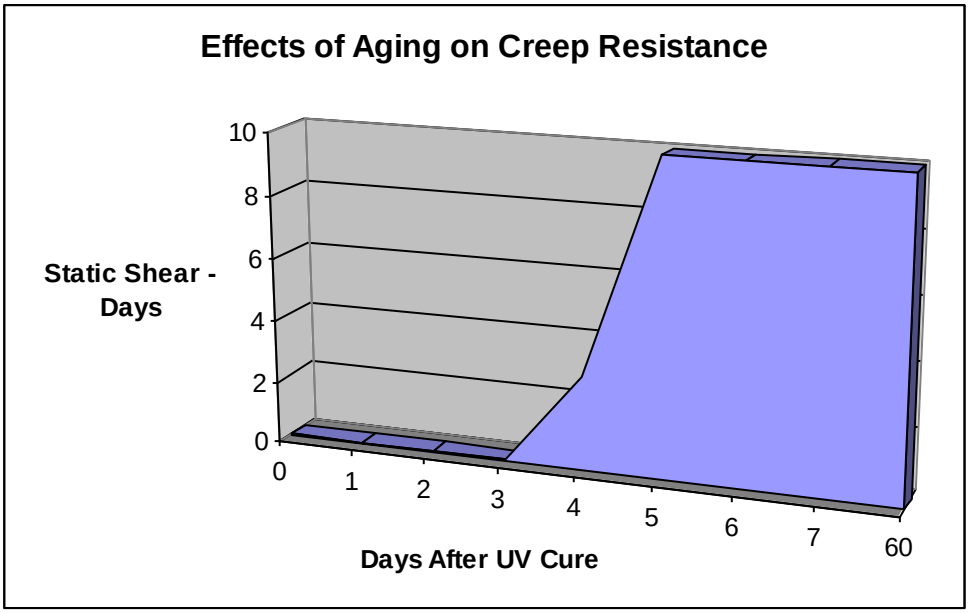
Substrate	Peel – pounds per linear inch (pli)	Failure Mode	Comment
PVC	9	Adhesive – all on Mylar	Skips at higher pull speed.
Acrylic	6-8	Mixed adhesive	Skips
Polycarbonate	11.5	Cohesive	Steady
Glass	10-11	Adhesive – all on glass	Steady
ABS	11	Mixed adhesive	Steady
Copper	11	Mixed adhesive	Steady
Polypropylene	1-2	Adhesive – all on Mylar	Skips

Static Shear or "Creep Resistance" Test.
To determine the resistance of the adhesive to "creep", the same assembly as for the peel test is prepared except that a one-inch overlap of the Mylar to steel is made. A one-kilogram weight is hung from the Mylar film and the number of hours recorded to failure. Greater than 10 days is considered a "passing" value.

CTECH UV PSA products undergo a dramatic improvement in static shear with ambient aging after UV cure. This aging occurs if the adhesive has been used to assemble parts or laminates as well as a film under a release liner.

Static Shear – PET to Steel. 3-mil adhesive, 1.0 J/cm2 doped bulb, 1 sq. in. overlap, 1 kilogram static load.

Ageing after UV	Time to Failure - minutes
12 hours	50 minutes
120 hours – 5 days	**>14,400 min (test halted at 10 days)**



Miscellaneous.

General Safety Considerations.
Read the MSDS for detailed and complete information. The uncured material is generally non-toxic and environmentally non-hazardous. HOWEVER – these are industrial chemicals and should be treated with care. The main safety concern is that over time repeated exposure to skin may cause dermatitis in some individuals. Workers should wear gloves and wash their hands and faces often. Nitrile, neoprene, latex and polypropylene gloves are all suitable with nitrile having the least chance of inducing sensitivity because of the glove materials. Work areas and UV curing stations should be well ventilated and exhausted.

Release Liner Suggestions.
CTECH PSA products are compatible with a wide range of siliconized release coatings. Fluorinated coatings and bare polyolefin sheet are not suitable. Liner substrates can be of paper, PET or any other material. However only smooth sheets on PET, PS etc. will maintain perfect optical qualities of the CTECH PSA products. Release coated paper will create a hazy, mottled appearance.

Radiometers.
Measurement of the UV output of production lamps is critical for process control and product traceability. Daily or weekly logs of the dose and/or intensity of UV systems should be part of any manufacturing documentation. These figures provide proof that the adhesive has been cured properly and therefore the assembled parts are within specification. The degradation of the bulbs can also be tracked and preventative maintenance schedules established.

Two companies that produce radiometers with the proper range of detection [1-20 Joules] at 365 nm are:
International Light Corporation. *http://intl-light.com/product/beltradiometer/*
EIT Corporation. *http://www.eit.com/ - Radiometers*

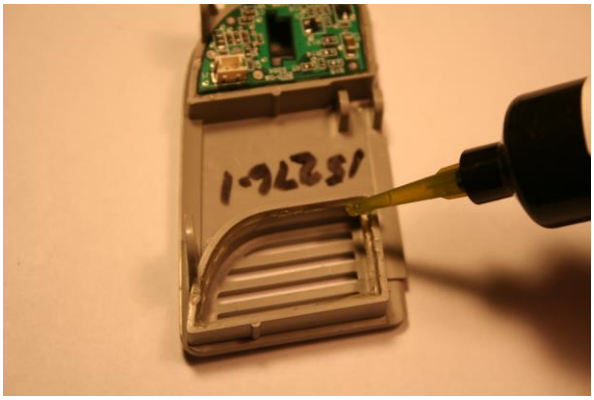
Cleanup.
Uncured product can be cleaned up with acetone or isopranol and paper towels. To clean hands and skin use soap and hot water – DO NOT USE SOLVENTS TO CLEAN SKIN!! – the solvents will drive material in to the skin. Cured product can sometimes also be wiped off with acetone depending on thickness and substrate.

Screen Printing CTECH 10-201-1A

CPVC Sign Letter and Fabric Attached to Wallboard with CTECH 10-201-1A

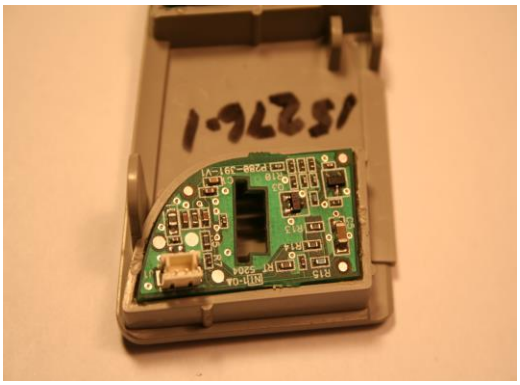
Dispense liquid product as a ring inside aluminum collar.

Dispense liquid product on inside edge of ABS platform.



***After* UV cure the collar is pressed onto polypropylene tube forming a robust mechanical seal resisting tensile and torque stresses.**

***After* UV cure the PC board is pressed into PSA bead forming mechanical and hermetic seal.**



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