The Evolution of Adhesives Used in Structural & Assembly Applications

THE ADHESIVE AND SEALANT COUNCIL, INC.

1940s – Present

DECADE	ACTION	BENEFIT
1940s	• Nitrile phenolics replace rivets in brake shoes	· No cylinder scratching, better braking service
1950s	• Anaerobic methacrylate adhesives replace lock washers in locking bolt applications	· Cost savings, less callback, longer service life
	• Pressure sensitive adhesives (PSAs) replace screws in appliance name/serial/face plate applications	· Cosmetic
1960s	• Acrylic PSA double-faced tape replaces mechanical fasteners to attach vehicle trim	· Improve corrosion resistance
	• Epoxy/plastisols replace welding in hood assembly	· Enhance anti-fluttering
	• Epoxy adhesive replaces rivets in bus assembly	· Improve structural integrity
	• Blocked sytrene butadiene rubber (SBR) adhesives replace nails in floor underlayment	· Improve structural integrity & reduces squeaking
	• Epoxy adhesives replace nails in vinyl lamination of particle board	· Improve construction speeds & aesthetics
	• Epoxy adhesives replace mechanical fasteners & welding in appliance assembly	· Allow use of coil-coated metals
	• Epoxy adhesives replace mechanical fasteners in glass syringe needle bonding application	· Speed assembly & improve reliability
	• Anaerobic methacrylate replaces mechanical press fits to adhere cup plugs in engines	· Improve manufacturing & reliability
	• Epoxies replace rivets on aircraft wing skins	· Improve aerodynamics & structural integrity
	• Silicone rubbers replace mechanical fasteners in auto side-view mirror applications	· Improve flexibility
	• SBRs replace cement in ceramic tile applications	· Easier to use
	• Epoxies replace mechanical fasteners in motor magnets	· Reduce vibration
1970s	• Acrylics replace mechanical fasteners in wire tacking	· Fewer parts
	• Blocked SBRs replace nails in drywall attachment, mobile homes & wood paneling	· Reduce surface finishing/nail popping
	• Epoxies replace mechanical fasteners in thermally conductive heat sinks for printed circuit boards	· Improve performance
	• Epoxies used in tennis racket construction	· Enable use of new design materials
	• Urethanes replace metal pins in picture frame kitchen cabinet doors	· Lower costs, higher production speeds, better appearance
	• Hot melt adhesives replace mechanical fasteners in appliance insulation bonding	· Improve insulating capability
	• Hot melts replace mechanical fasteners in appliance sound deadening insulation application	· Reduce noise
	• Epoxies replace mechanical fasteners in curtain wall manufacture	· Less weight
	• Cyanoacrylates replace mechanical fasteners in speaker magnets	· Improve sound & construction speed
	• Cyanoacrylates replace mechanical fasteners in motor magnets	· Reduce vibrations
1980s	• Epoxies replace welding/sealants in hem flanges	· Reduce cost, no read through, improve corrosion resistance
	• 2-component urethanes replace mechanical fasteners in metal to plastic auto assembly	· Join dissimilar substrates
	• 2K urethanes replace mechanical fasteners in plastic to plastic auto assembly application	· Allow SMC clamshell configuration
	• SBRs replace nails in wood flooring	· Ease finishing
	• Urethanes replace mechanical fasteners in windshield placement	· Improve structural integrity, reduce weight
	• Urethanes replace nails & screws in residential exterior door gaskets	· Improve insulating factor
	• Urethanes replace nails & screws in wood furniture applications	· Speed production
	• Hot melts replace screws in auto interior plastic bonding application	· Reduce noise, improves recyclability
	• Foamed epoxy replaces mechanical fasteners in automotive pillars	· Reduce twisting, noise; improve structural integrity
	• Epoxies replace welds in auto side crash bars	· No read through, improve corrosion resistance & structural integrity
	• UV curable acrylics replace thermal methods in plastic syringe needle bonding	· Improve reliability & speed
	• UV curable acrylics & cyanoacrylates replace mechanical fasteners in automotive headlamp assembly	· Faster processing & resist moisture leaks
	• UV/visible light cure acrylics replace mechanical clips with gaskets in fluid reservoirs for dialysis filters	· Reduce costs, speed manufacture, improve reliability & testing ease
	• Acrylics/epoxies/UV cyanoacrylates eliminate pin clips & sockets in chip-on-board bonding applications	· Lower costs, increase miniaturization, improve thermal management
	• Structural acrylics replace mechanical fasteners in thermoplastic bumper assemblies	· Lower cost, increase styling, automates assembly
	• Emulsion polymerized isocyanates used to cap ends of laminated wood I-beam joists	· Reduce costs, increase reliability
	• Epoxies replace welding in refrigeration coil spacers	· Allow thinner materials, noise reduction
1980s (cont.)	• Epoxies replace solder in 2-sided printed circuit boards	· Smaller & thinner parts
	• Epoxies replace solders in flip chip mounting	· Improve flexibility & impact resistance for cell phones
	• Epoxies replace mechanical fasteners in snow mobiles	· Eliminate loosening
	• Epoxies replace rivets in aircraft skin attachments	· Reduce weight & resist temperature gradients
	• 1K methacrylates replace less robust fasteners in multi cure electronic adhesives	· Improve manufacturing flexibility
	• Epoxies replace mechanical fasteners in coil coated refrigerator door skins	· No holes, smooth surfaces
1990s	• Urethanes replace welding/sealants in hem flange	· No read through, lower cost, better corrosion resistance
	• Epoxies replace spot welding in weld bonding applications	· Strengthen construction, improve flexibility, weight & noise reduction
	• Urethanes replace mechanical fasteners in vehicle trim attachments	· Improve corrosion resistance
	• VHB™ acrylic PSA tapes replace solder/mechanical fasteners in sign assembly	· Improve speed & aesthetics
	• PSAs replace nails in picture handing	· No holes, marred walls
	• Epoxies replace welding in metal to metal auto assembly	· Improve corrosion resistance, production speeds
	• Epoxies replace welding in automotive firewall to floorboard bonding	· Improved protection & structural integrity
	• Epoxies replace mechanical fasteners in plastic-to-plastic auto assembly	· Allow SMC clamshell configurations
	• Urethane hot melts replace mechanical spiral binding in book binding	· Allow books to lie flat – speeds shipping
	• Urethanes replace mechanical fasteners in backlight placement	· Improve structural integrity & reduce weight
	• Urethane replace nails & screws in kitchen cabinet frames	· Reduce noise
	• Urethanes replace nails & screws in laminated furniture	· Cost savings
	• Urethanes replace metal pins in door frames	· Faster assembly
	• Urethanes replace nails in furniture decorating	· Eliminates surface finishing
	• Urethanes replace nails in wood decks	· Improved aesthetics, structural integrity, no nail popping
	• UV cure acrylics & cyanoacrylates used in catheter assembly	· Improve reliability, speed
	• UV cure acrylics & cyanoacrylates replace alternative molding methods in inhalation masks	· Reduce costs, simplify manufacturing, & improve speeds
	• Semi-pressure sensitive hot melts replace solvent based thermoplastic urethanes in automotive carpet panels	· Eliminate solvents & exhaust hoods
	• Internal hot melts ("electromagnetic induction bonding") replace one component methods in polyolefin chemical toilet reservoir tanks	· Lower costs
	• Epoxies replace welding in steel office file cabinets	· No read through, lower cost, adhere after painting
	• Epoxies replace welding in auto roof cross braces	· Ease production, improve structural integrity
	• Epoxies replace rivets in truck trailer aluminum roof skins	· Smooth surface, improve corrosion resistance & structural integrity
	• Epoxies allow new construction materials for surf boards, snow boards, skis & bicycles	· Seals & bonds
	• 2K urethane replaces mechanical fasteners & gaskets in jet skis	· Improve structural integrity
	• Urethanes allow bladder press to laminate film on kitchen cabinet doors	· No holes, improves corrosion resistance
	• 2-sided acrylic tape replaces metal clips in automotive exterior trim	· Reduce cost, fewer windshield breaks
	• Acrylic tape replaces screws in automotive leaf screen molding	· Safer, faster processing
	• 1K methacrylate used in electronics adhesives which cure quickly via UV or visible light	· Replace higher shrinkage adhesives
	• Methacrylates used in low shrinkage adhesives for securing critical electronic & optical components	· Better sealing against moisture & chemicals
2000s	• VHB™ acrylic PSA tapes replace welds in ambulance/panel trucks	· Improve structural integrity & corrosion resistance, no read through
	• Silicones replace welding in automotive wire wheels	· Ease of assembly
	• VHB™ acrylic PSA tapes replace rivets in truck trailer aluminum side skins	· Smoother surfaces, better corrosion resistance & structural integrity
	• Wind mill blades bonded with acrylic adhesives	· Improve structural integrity (improved peel/shear resistance to blade flexural fatigue; wind power industry attracts greater interest)

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