Acrylonitrile-Styrene-Acrylate Copolymer

Welding

BASF AG: Luran S (features: natural resin)

Luran S extruded stock and moldings can be welded by hot-shoe or spin techniques. In certain cases, high-frequency and ultrasonic welding may be resorted to. Luran S articles may also be welded by ultrasonic techniques to other thermoplastics, e.g., SAN, ABS, PVC and PMMA.

Reference: *Luran S Acrylonitrile Styrene Acrylate Product Line, Properties, Processing,* supplier design guide (B 566 e / 10.83) - BASF Aktiengesellschaft, 1983.

Vibration Welding

GE Plastics: ASA

Table 63.1: Achievable strengths of vibration welds of Acrylonitrile-Styrene-Acrylate copolymer (ASA) to itself.

Material Family	ASA
Tensile Strength[2], MPa (ksi)	32.5 (4.7)
Elongation @ Break[2], %	2.9
Specimen Thickness, mm (in.)	6.3 (0.25)
Mating Material	
Material Family[1]	ASA
Tensile Strength[2], MPa (ksi)	32.5 (4.7)
Elongation @ Break[2], %	2.9
Specimen Thickness, mm (in.)	6.3 (0.25)
Process Parameters	
Process Type	vibration welding
Weld Frequency	120 Hz
Welded Joint Properties	
Weld Factor (weld strength/ weaker virgin material strength)	0.46
Elongation @ Break[2], % (nominal)	0.9

[1] ASA - Acrylonitrile-Stryrene-Acrylate Copolymer
[2]strain rate of $10^{-2}s^{-1}$

Reference: Stokes, V.K., *Toward a Weld-Strength Data Base for Vibration Welding of Thermoplastics,* ANTEC 1995, conference proceedings - Society of Plastics Engineers, 1995.

Adhesive and Solvent Bonding

BASF AG: Luran S (features: natural resin)

Luran S (ASA) articles can be bonded together by solvents such as 2-butanone, dichloroethylene and cyclohexane. These solvents allow moldings made of different Luran S types to be bonded together and also Luran S articles to be bonded to Terluran (ABS) or Luran 378 P and 388 S (SAN).

Reference: *Luran S Acrylonitrile Styrene Acrylate Product Line, Properties, Processing,* supplier design guide (B 566 e / 10.83) - BASF Aktiengesellschaft, 1983.

Adhesive Bonding

GE Plastics: Geloy XP1001-100

A study was conducted to test for bond strength on a representative matrix of commonly used plastics and the adhesives best suited to them. For many of the plastics evaluated, the effect of polymer composition on bond strength was evaluated by compounding plastic formulations with each of the most commonly used additives and fillers for that plastic; common grades were used for the remaining resins. The effect of each additive and filler was determined by comparing the bond strength achieved with the specially compounded formulations to that of the neat plastic. In addition, the effect of surface roughening and chemical treatment of the plastic surface on bond strength was examined.

The block-shear (ASTM D 4501) test was chosen as the test method because it places the load on a thicker section of the test specimen that can withstand higher loads before experiencing substrate failure. In addition, the geometry of the test specimens and the block-shear fixture helps minimize peel and cleavage forces in the joint. How well the block-shear test method reflects the stresses that an adhesively bonded joint will experience in real world applications should be considered. Also, limitations on the data due to the variety of additives and fillers used by different companies should not be ignored.

The three cyanoacrylates tested, namely Black Max 380, Prism 401, and Super Bonder 414, all created bonds which were stronger than the substrate on almost all of the ASA formulations evaluated. Loctite 3105, a light curing acrylic adhesive, did not achieve substrate failure, but did perform well on ASA. Depend 330, a two-part no-mix acrylic adhesive, achieved the lowest bond strengths on ASA.

Surface Treatments
The effect of using Prism Primer 770, in conjunction with Prism 401, could not be determined because both primed and unprimed ASA achieved substrate failure for most of the formulations evaluated. Surface roughening had an inconsistent effect on the bondability of ASA.

Other Information
ASA can be stress cracked by uncured cyanocrylate adhesives, so any excess adhesive should be removed from the surface immediately. ASA is compatible with acrylic adhesives but can be attacked by their activators before the adhesive has cured. Any excess activator should be removed from the surface immediately. ASA is incompatible with anaerobic adhesives. Recommended surface cleaners are isopropyl alcohol and Loctite ODC Free Cleaner 7070.

Table 63.2: Shear strengths of ASA to ASA adhesive bonds made using adhesives available from Loctite Corporation. Values are given in psi and (MPa).[b,c]

Plastic Material Composition (GE Plastics Geloy XP1001-100)		Loctite Adhesive					
		Black Max 380 rubber toughened cyanoacrylate (200 cP)	**Prism 401** surface insensitive ethyl cyanoacrylate (100 cP)	**Prism 401/ Prism Primer 770** polyolefin primer for cyanoacrylate	**Super Bonder 414** general purpose cyanoacrylate (110 cP)	**Depend 330** two-part no-mix acrylic	**Loctite 3105** light cure acrylic (300 cP)
Unfilled resin	4 rms	>1650 [a] (>11.4)[a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1700[a] (>11.7) [a]	950 (6.6)	1300 (9.0)
Roughened	28rms	>1650 [a] (>11.4) [a]	>1900 [a] (>13.1) [a]	1150 (7.9)	>1850 [a] (>12.8) [a]	700 (4.8)	1300 (9.0)
Antioxidant	0.2% Irganox 245	>1650 [a] (>11.4) [a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1700 [a] (>11.7) [a]	950 (6.6)	1300 (9.0)
UV stabilizer	0.5% Tiinuvin 770 0.5% Tinuvin P	>1300 [a] (>9.0) [a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1700 [a] (>11.7) [a]	950 (6.6)	1300 (9.0)
Flame retardant	20% F2016	>1650 [a] (>11.4 [a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1700 [a] (>11.7) [a]	650 (4.5)	1300 (9.0)
Impact Modifier	9% Paraloid EXL3330	>1650 [a] (>11.4) [a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1850 [a] (>12.8) [a]	950 (6.6)	1300 (9.0)
Lubricant	0.3% Mold Wiz INT SP8	>1650 [a] (>11.4 [a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1700 [a] (>11.7) [a]	950 (6.6)	1300 (9.0)
Colorant	1% OmniColor Nectarine	>1650 [a] (>11.4) [a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1700 [a] (>11.7) [a]	950 (6.6)	1300 (9.0)
Antistatic	1.5% Dehydat 93P	>1650 [a] (>11.4) [a]	>1750 [a] (>12.1) [a]	>1750 [a] (>12.1) [a]	>1700 [a] (>11.7) [a]	950 (6.6)	1300 (9.0)

[a] The force applied to the test specimens exceeded the strength of the material resulting in substrate failure before the actual bond strength achieved by the adhesive could be determined.
[b] All testing was done according to the block shear method (ASTM D4501).
[c] For more information on data presented in this table, contact Loctite Corporation at 800-562-8483 (1-800-LOCTITE). Request the "Design Guide for Bonding Plastics."

Reference: *The Loctite Design Guide for Bonding Plastics,* supplier design guide (LT-2197) - Loctite Corporation.

Mitsubishi Rayon: Shinko-Lac

For adhesion of Shinko-Lac ASA to woods or metals, adhesives made of neoprene or epoxy resins are recommended, depending on the applications.

Reference: *Shinko-Lac ASA Weatherable And Heat Resistant ASA Resin,* supplier design guide (9011-1000 (H) B) - Mitsubishi Rayon Company, 1990.

Solvent Bonding

Mitsubishi Rayon: Shinko-Lac

Bonding products made of Shinko-Lac ASA can be easily performed using organic solvents.
Methyl ethyl ketone, ethylene dichloride or methylene dichloride are recommended. Solutions of Shinko-Lac ASA dissolved in any of the above mentioned solvents at a concentration of 5% to 10% are available.

Reference: *Shinko-Lac ASA Weatherable And Heat Resistant ASA Resin,* supplier design guide (9011-1000 (H) B) - Mitsubishi Rayon Company, 1990.