



**ES-224  
HIGH TEMPERATURE  
SURFACE COAT  
ABRASION RESISTANT**



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**DESCRIPTION**

ES-224 High Temp Surface Coat is formulated for use in tooling applications where increased wear resistance in a high-temperature environment is required. The abrasion resistance of ES-224 allows for a very strong, long lasting, and durable tool surface, even under the harshest of conditions. ES-224 exhibits excellent handling characteristics and air release, creating a tool surface with a high degree of integrity and minute detail replication.

The material "B" stages in 16-20 hours at room temperature and can be cured per the recommended schedule below or pre-conditioned with intermittent usage until full properties are obtained. Use with any of the ADTECH High Temperature Laminating Systems or High Temperature Casting Systems. **Typical applications include: compression molds, oven and autoclave bonding fixtures, vacuum form molds, prototype injection molds, resin transfer molds, reactive injection molds and other applications which require elevated temperatures and abrasion resistance.**

**TYPICAL HANDLING CHARACTERISTICS @ 77°F (25°C)**

Mix Ratio (parts by weight) .....	100R/9H
Density (mixed) .....	14.8 lbs/gallon
Specific Gravity .....	1.77 g/cc
Resin Viscosity .....	74,000 cps
Hardener Viscosity .....	240 cps
Mixed Viscosity .....	18,500 cps
Work Life (327 gram mass) .....	60 minutes
Tack Free Time .....	2-3 hours
Demold Time .....	16-24 hours
Resin Color .....	Gray
Hardener Color .....	Amber
Mixed Color .....	Gray
Shelf Life ES-224 Resin (in original unopened container) .....	1 year
Shelf Life ES-224 Hardener (in original unopened container) .....	2 years

**TYPICAL PHYSICAL PROPERTIES**

Ultimate Tensile Strength (ASTM D-638.91) .....	4,912psi (34MPa)
Tensile Elongation (ASTM D-638.91) .....	0.143%
Ultimate Flexural Strength (ASTM D-790.92) .....	10,140psi (70MPa)
Flexural Modulus (ASTM D-790.92) .....	680,000psi (4,688MPa)
Coefficient of Thermal Expansion by TMA (ppm/°F (°C)) .....	23.14 x 10 <sup>-6</sup> in/in °F (41.65)
Heat Deflection Temperature @ 264 psi (ASTMD-648.82) .....	174°F (79°C)
Notched Izod Impact Strength (ASTM D-256.93A) .....	8.34 in-lbs/in
Hardness (ASTM D-2240.91) .....	89-91 Shore D
Glass Transition Temperature by DSC (Recommended Post Cure) .....	202°F (94°C)
Glass Transition Temperature by DSC (Alternate Post Cure) .....	264°F (129°C)

**RECOMMENDED CURE SCHEDULE**

24 hours @ 77°F (25°C)  
+3 hours @ 150°F (66°C)

**ALTERNATE CURE**

24 hours @ 77°F (25°C)  
+2 hours @ 150°F (66°C)  
+2 hours @ 250°F (121°C)

Curing to a temperature 25°F (14°C) above the required service temperature is recommended.

Insure proper heat curing temperatures are met by installing a thermocouple directly in the center of the tool.

NOTE: The post cure schedule of the high-temp tooling epoxy laminate or casting system used with your surface coat would have precedence over that of the surface coat. However, to attain suitable high temperature resistance and chemical resistance, the surface coat is recommended to be post cured to a minimum of 200°F (93°C).

**HEATING AND COOLING RATES DURING POST CURE**

Always allow tools made with ADTECH high temperature systems to gel at room temperature before subjecting them to post cure (24 hours is usually sufficient). This will prevent excessive exotherm and shrink stress from occurring.

When oven curing laminated molds always place mold in a room temperature oven. Increase oven temperature at a rate of no more than 50°F (30°C) per hour. When heat cure is completed, turn off oven and allow molds to remain in the oven. Never remove mold from oven until mold temperature has been lowered to less than 100°F (38°C).

ES-224 Tech/Revised 1/13/15  
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