Design Considerations In Transitioning To Aluminum Ribbon

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ELECTRONIC COMPONENTS AND PACKAGING

Topics for Discussion

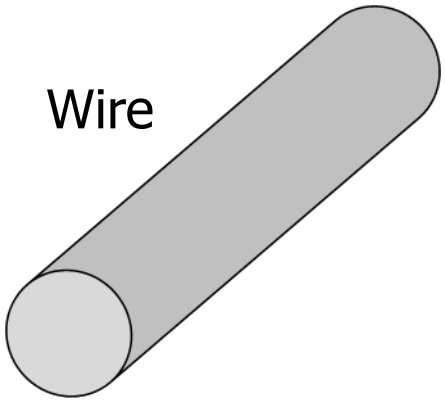
- Overview
- Physical & Mechanical Properties
- Burnout Current
- Sizes & Tolerances
- Equivalences
- Spooling
- Advantages Of 41 R Spool
- Bonding Tools
- Hardware
- Advantages Of Ribbon In Power Devices
- Cautions
- Conclusions

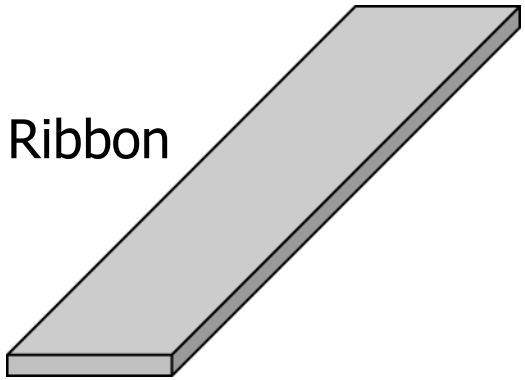
Why Ribbon?

- Better Electrical Characteristics
- Improved Heat Dissipation
- Fewer Bonds
- Improved Reliability
- Potentially Improved Throughput

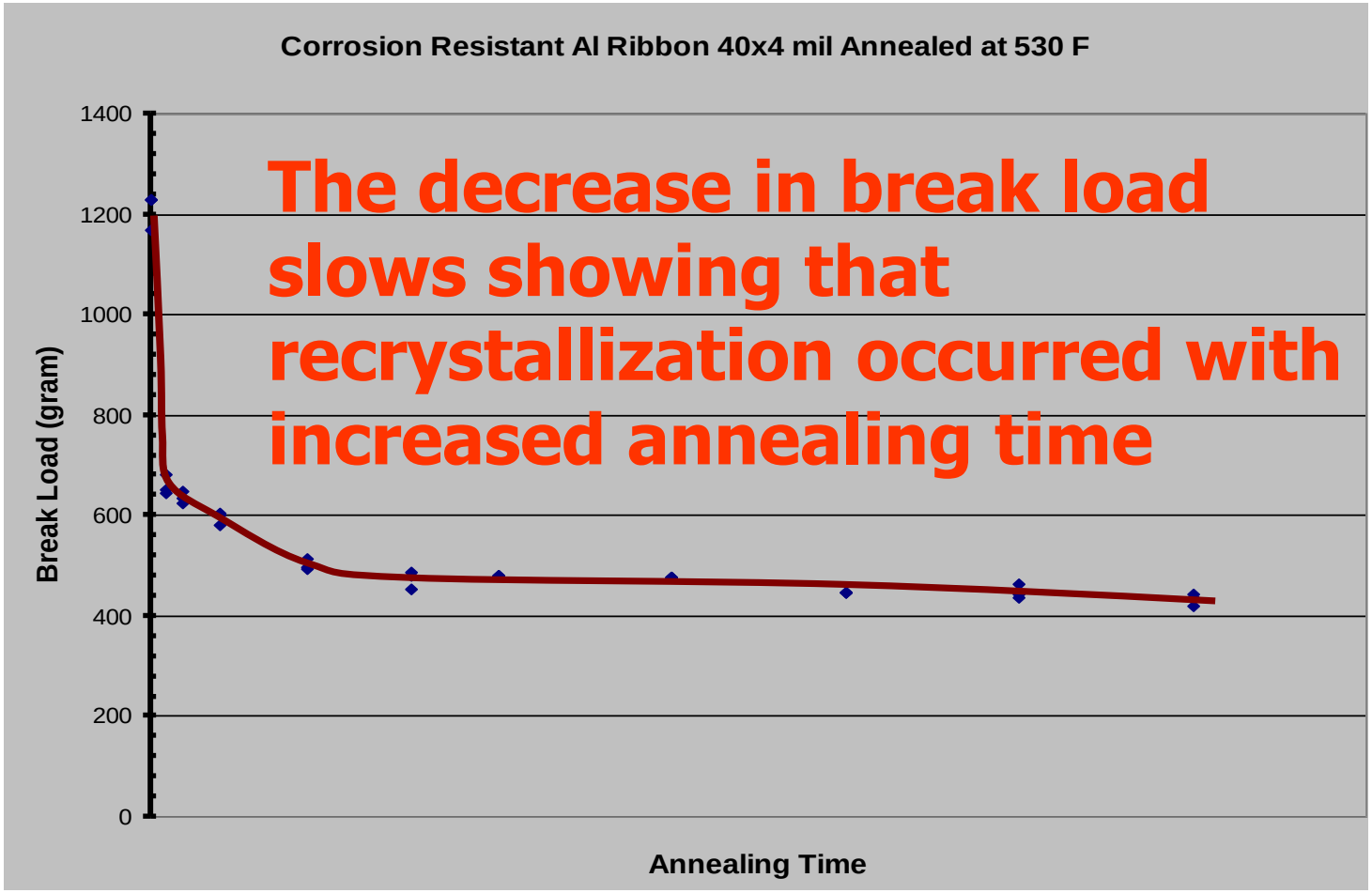
Ribbon Defined

- Essentially Flat Wire
- Rectangular Cross Section
- Material is 99.99% Al doped for Corrosion Resistance
- Multiple Manufacturing Methods Available





Physical Properties vs. Annealing



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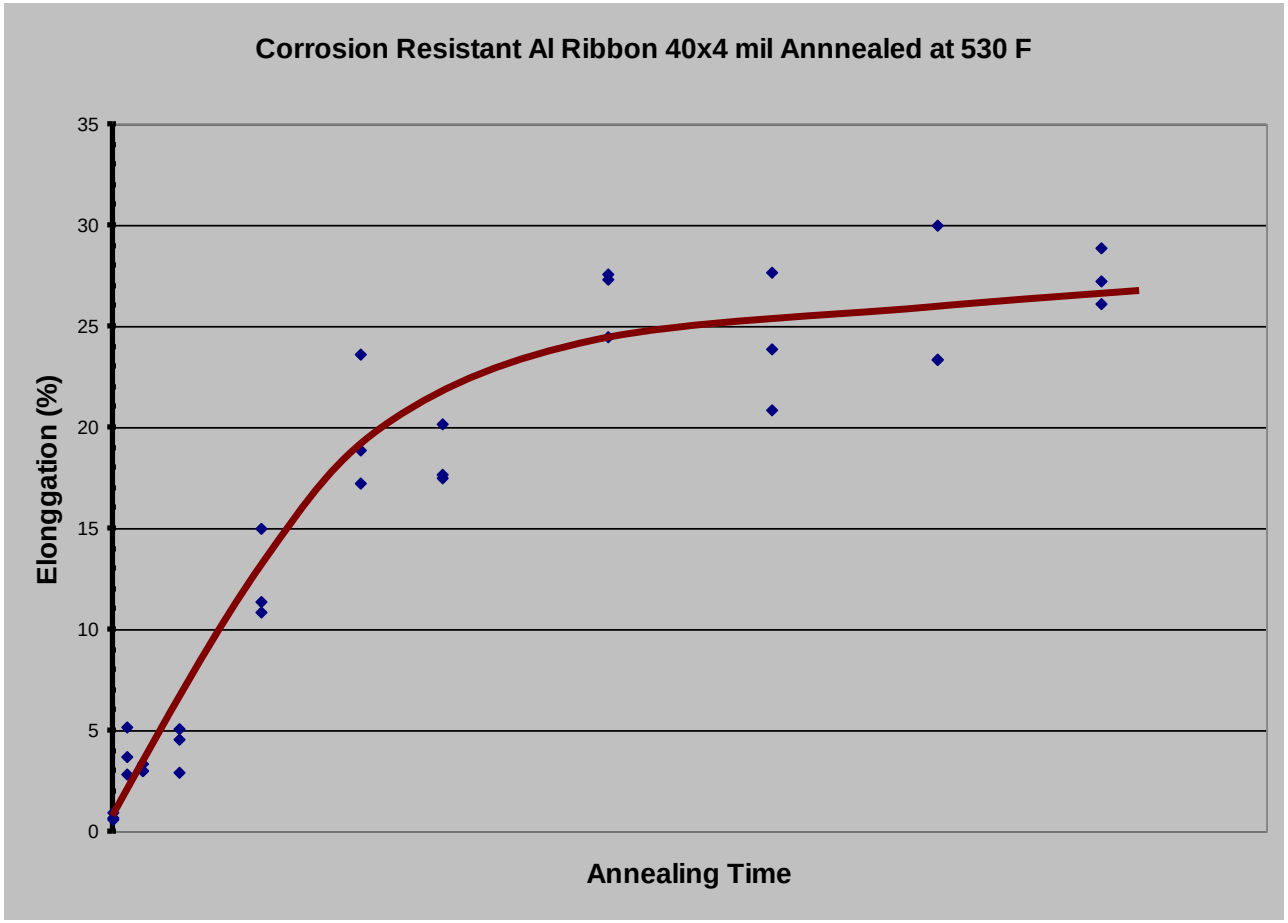

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Burnout Current

Size (mils)	Amps	Size (mils)	Amps	Size (mils)	Amps
80 X 10	76	60 X 8	55	40 X 4	24
80 X 9	68	60 X 7	46	40 X 3	18
80 X 8	60	60 X 6	40	40 X2	11
80 X 7	50	60 X 5	30		
80 X 6	45	60 X 4	26		
80 X 5	42	60 X 3	20		
80 X 4	35	60 X 2	14		
80 X 3	30				

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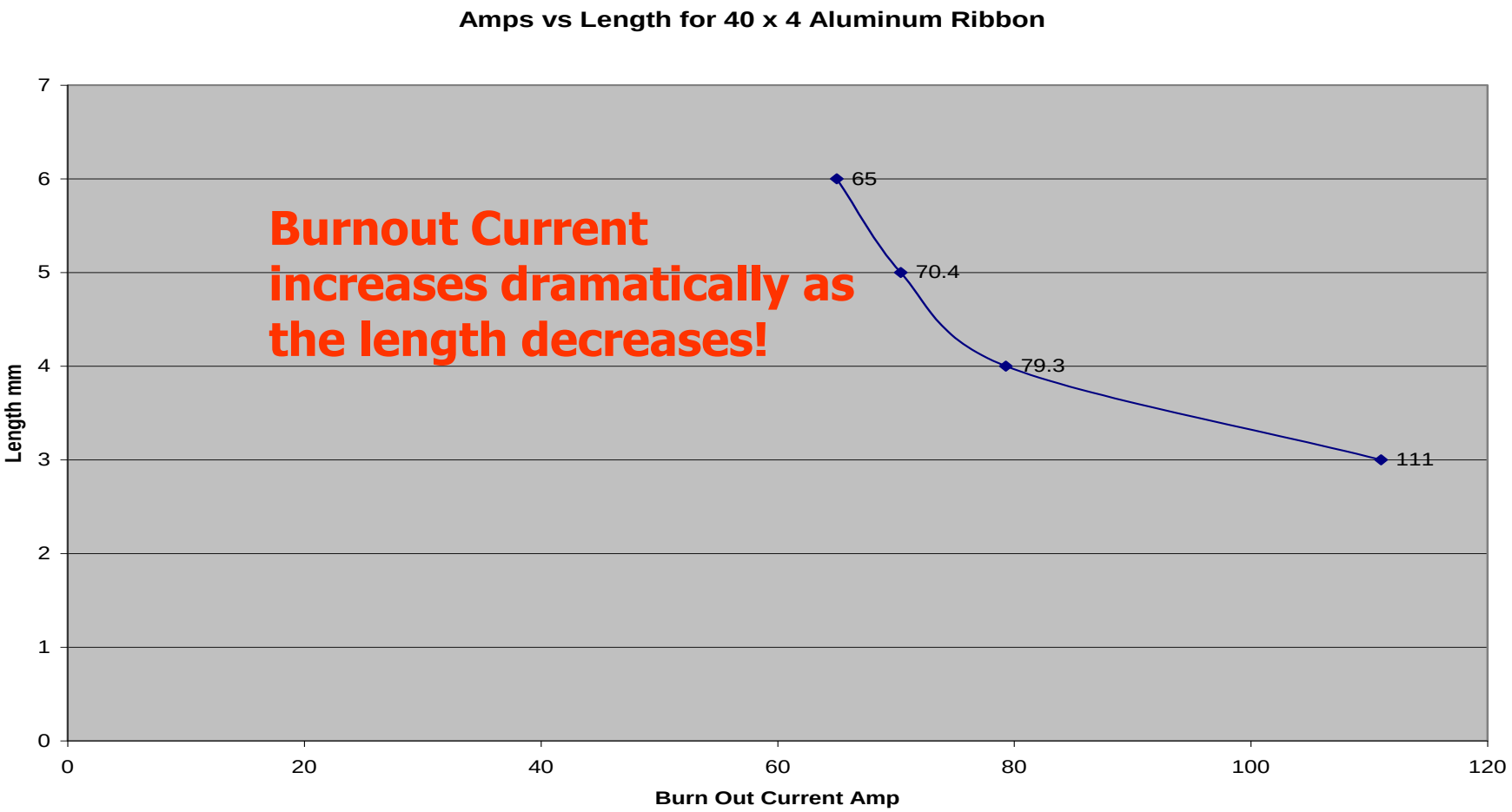
Burnout Current Vs Length Of Ribbon



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Typical Sizes

SIZE (MILS)	TENSILE (GMS)	ELONG. %	QTY/41R
30 X 3	250-350	15-25	125 MTRS
40 X 4	500-750	20-30	90 MTRS
50 X 5	1000-1500	20-35	80 MTRS
40 X 6	700-1100	20-35	70 MTRS
60 X 6	1300-1700	20-35	70 MTRS
80 X 6	1800-2200	20-35	70 MTRS
50 X 8	1500-2000	20-35	55 MTRS
60 X 8	2000-2500	20-35	55 MTRS
80 X 8	2300-2800	20-35	55 MTRS
60 X 10	2200-2600	25-40	38 MTRS
80 X 10	2700-3400	25-40	38 MTRS

Usual Tolerances: ± 2 mil Width
± 0.3 mil Thickness

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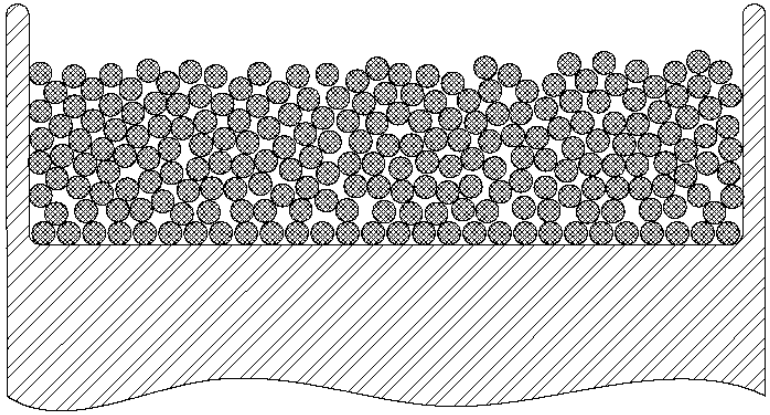
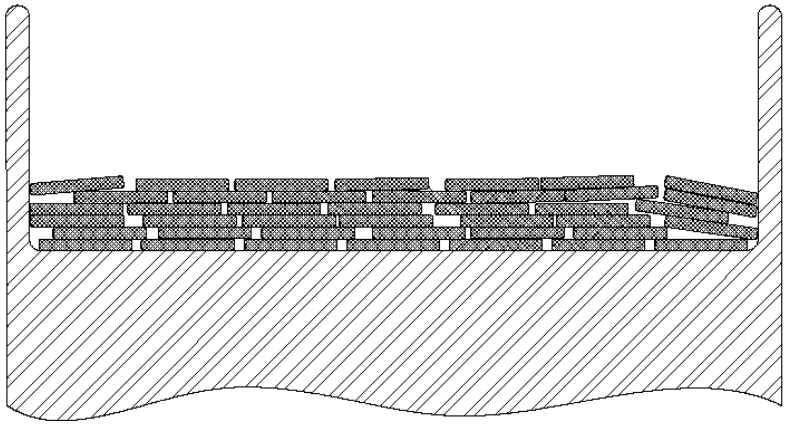
Ribbon to Wire Conversion

Equivalent Number of Wires to Ribbon Conversion						
	Wire diameter (mils)					
Ribbon Size (mils)	5	8	10	12	15	20
30 x 3	4.58	1.79	1.15	-	-	-
40 x 4	8.15	3.18	2.04	1.41	-	-
40 x 6	12.22	4.77	3.06	2.12	1.36	-
60 x 8	24.45	9.55	6.11	4.24	2.72	1.53
80 x 10	40.74	15.92	10.19	7.07	4.53	2.55

Spooling

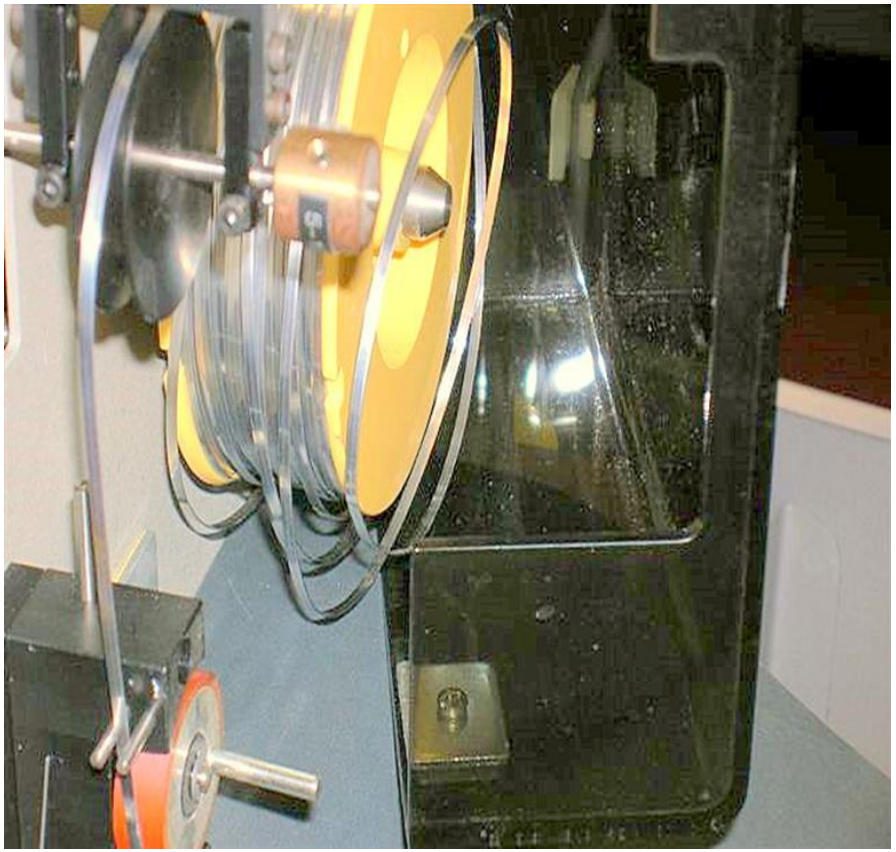


Wire Build Up On Spool



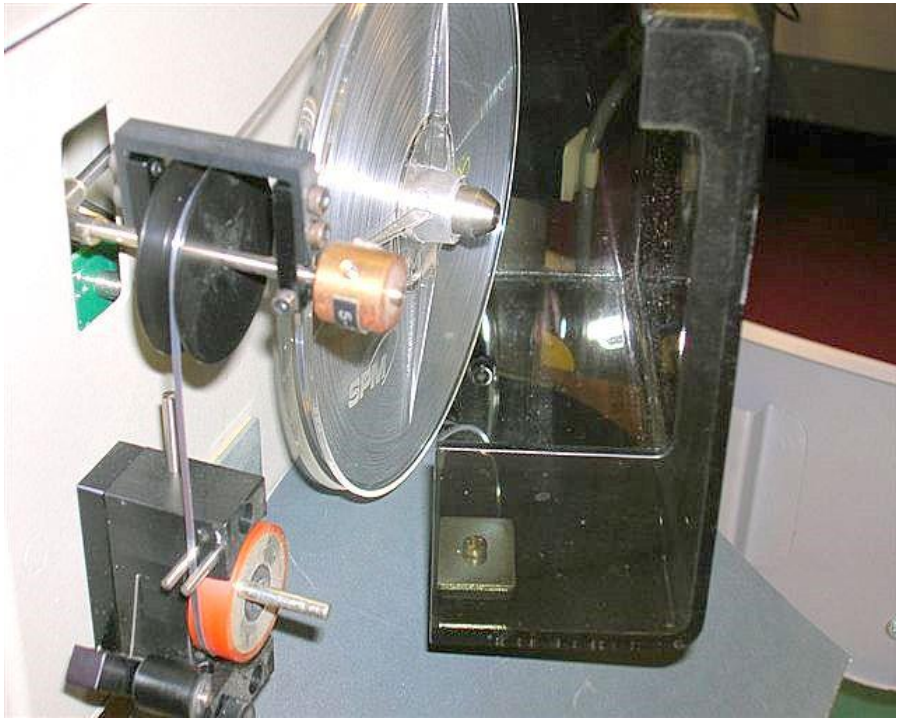
Ribbon Build Up On Spool

Multilayer Spool



- **Potential Issues If Winding Tension Is Not Maintained**
  - Tangling
  - Increased downtime
  - Material losses

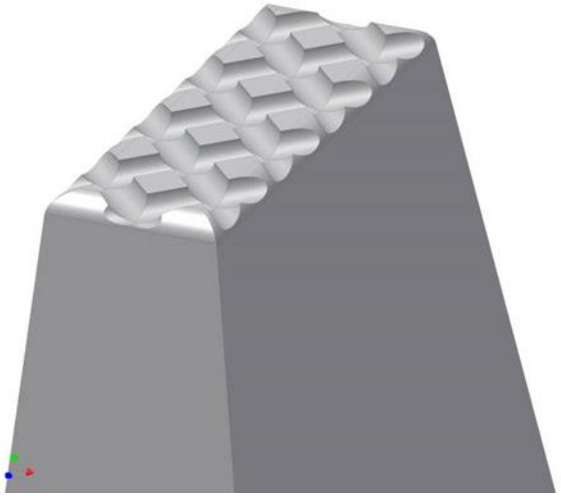
Benefits Of 41R Spool

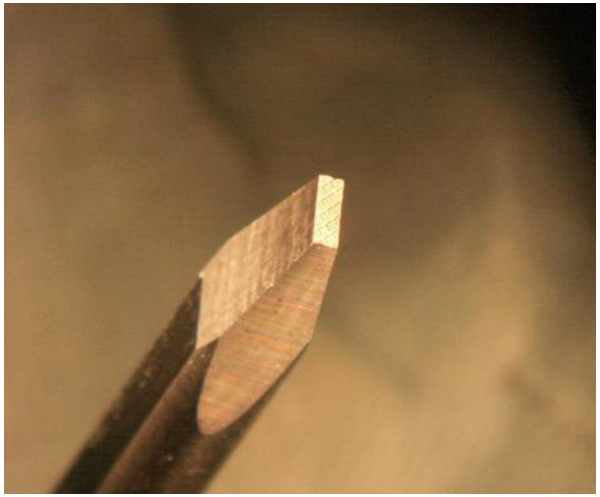


- Will Not Underwind Even With Lost Tension
- Compatible With All Heavy Wire Bonders
- Less ft/spool Than Multilayer Spool

Bonding Tool Design

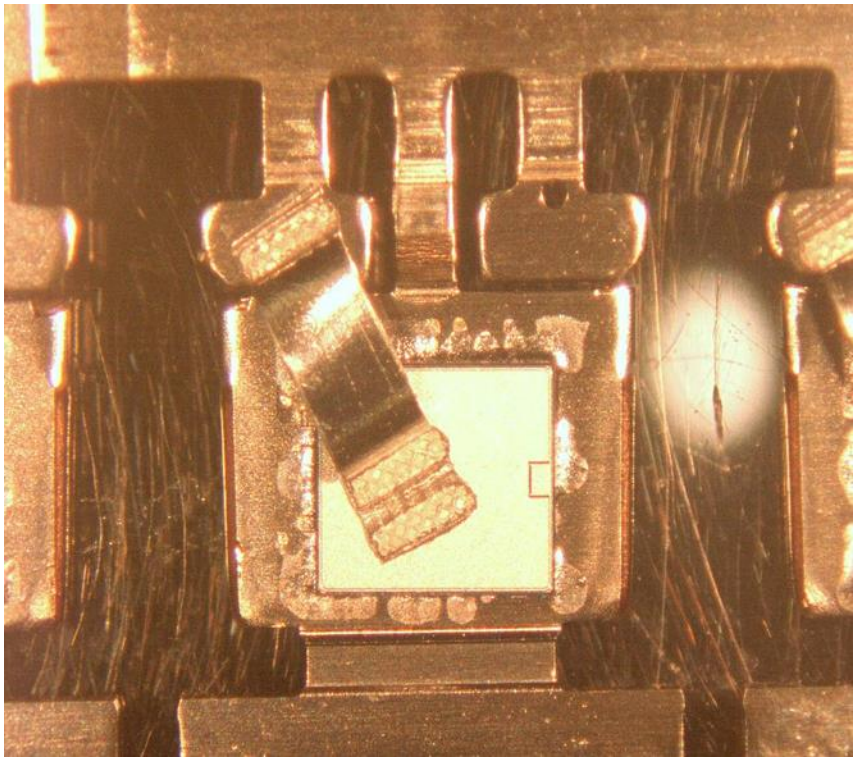
- Cross Hatch Pattern
  - Holds ribbon during feeding & bonding
  - Improves Al diffusion at bond interface

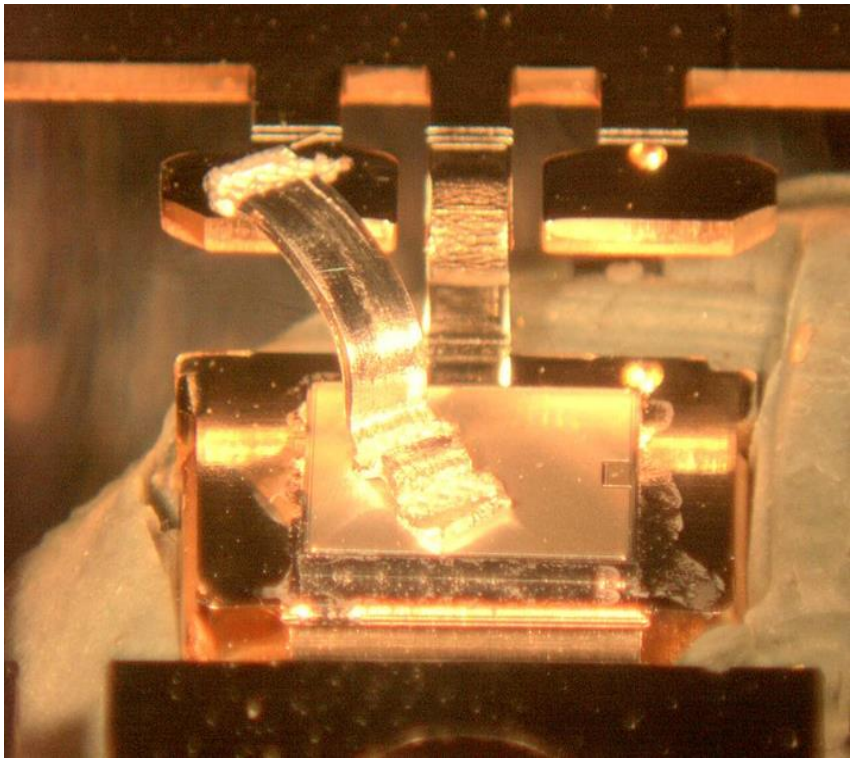




Photos Courtesy of DeWeyl Tool Company

Leadframe Applications





Note: Single Bond And Change In Elevation With Low Loop Characteristics

Cautions

- Mid-bond Direction Changes Are More Challenging
- Cost Per Unit Length Of Al Ribbon Is Higher Than Wire
- Costs For Equipment Conversion

Conclusions

- **Ribbon Is Viable Alternative To Multiple Heavy Wire Bonds**
  - **High Reliability**
  - **Better Throughput**
  - **Low Profiles**