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About KVA, Inc.:

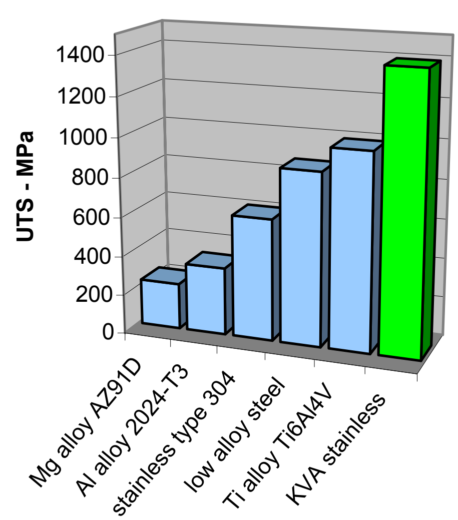
Located in southern California, KVA, Incorporated is a growing R&D venture focused on developing and promoting uses for low-cost advanced high strength martensitic stainless alloys. KVA's technical staff, with a combined 60 years experience in thermal processing, metallurgy, automated welding, brazing and mechanical design, have developed numerous proprietary and patent-pending processing and manufacturing methods to enable the use of high-strength, lightweight, corrosion-resistant, hardened stainless steel components throughout industry.

KVA's president, Mr. Ed McCrink, founded Hi-Temp, Inc. in 1953 and grew the company to become one of the largest processors of martensitic stainless steels in North America. Since successfully selling the Hi-Temp, Inc. plants in the 1970's, he has continuously pursued his vision of utilizing commonly available martensitic stainless steels to reduce weight and increase strength in structures.

KVA's research and development efforts, privately funded by Mr. McCrink, are dedicated to developing, educating and licensing intellectual property regarding martensitic stainless processing, automated welding and production heat-treating to arrive at cost-effective, superior mechanical and structural solutions.

As the charts and tables below indicate, the superior mechanical properties of KVA martensitic stainless allows for significant weight savings and/or stronger components.

Comparison of Ultimate Tensile Strengths



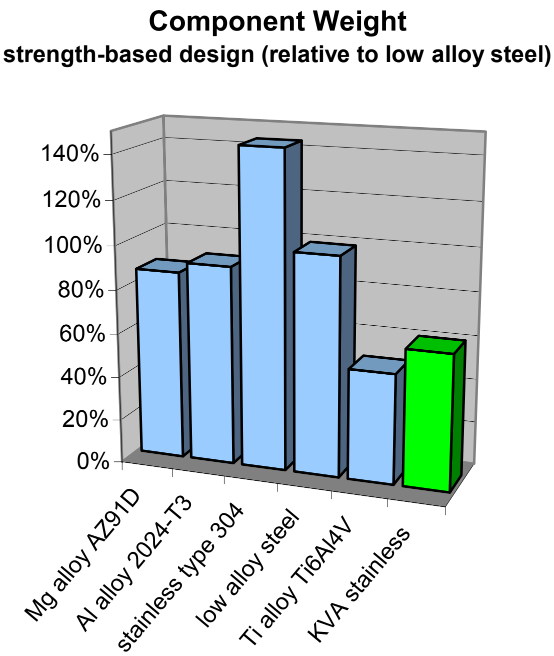
	density	E	UTS	Specific modulus	specific strength	cost index	specific cost index
	g/cm^3	GPa	MPa	GPa/g/cm^3	MPa/g/cm^3	cost/weight (low alloy steel=1)	cost/volume (low alloy steel=1)
Mg alloy AZ91D	1.80	45	234	25.00	130.0	4.25	0.97
Al alloy 2024-T3	2.80	72	345	25.71	123.2	3.75	1.34
Stainless type 304	8.00	193	621	24.13	77.63	3.05	3.11
low alloy steel	7.85	206	880	26.24	112.1	1.00	1.00
Ti alloy Ti6Al4V	4.49	121.5	1000	27.06	222.7	20.00	11.44
KVA stainless	7.74	200	1400	25.84	180.9	2.40	2.37

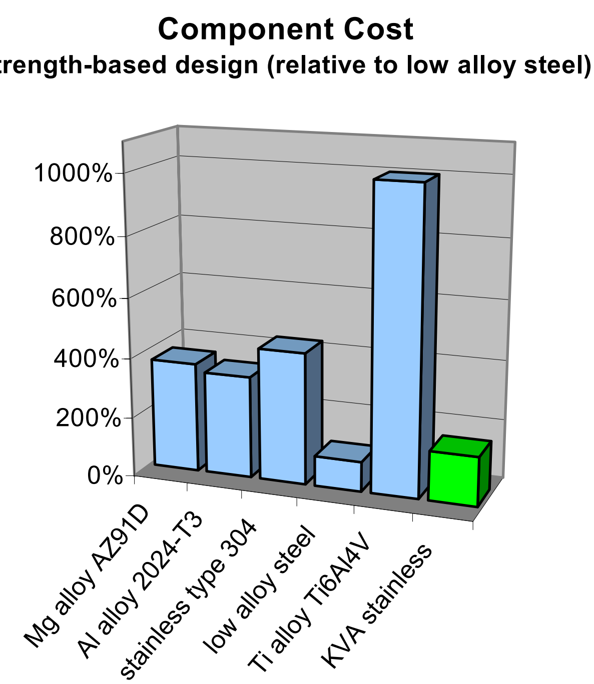
Mechanical Properties and Costs of common engineering metals compared to KVA martensitic stainless technology

While martensitic stainless alloys cost more per-pound than low alloy 'mild' steels, designs using KVA technology are easily capable of weight savings far exceeding traditional costly high-performance engineering metals, such as aluminum and magnesium alloys. ***In fact, parts designed with KVA stainless achieve weight reductions rivaling those using titanium alloys, but at a mere 1/5th of the cost.***

	relative weight: optimized part	material cost: optimized part
Mg alloy AZ91D	86%	366%
Al alloy 2024-T3	91%	341%
Stainless type 304	144%	440%
low alloy steel	100%	100%
Ti alloy Ti6Al4V	50%	1007%
KVA stainless	**62%**	**164%**

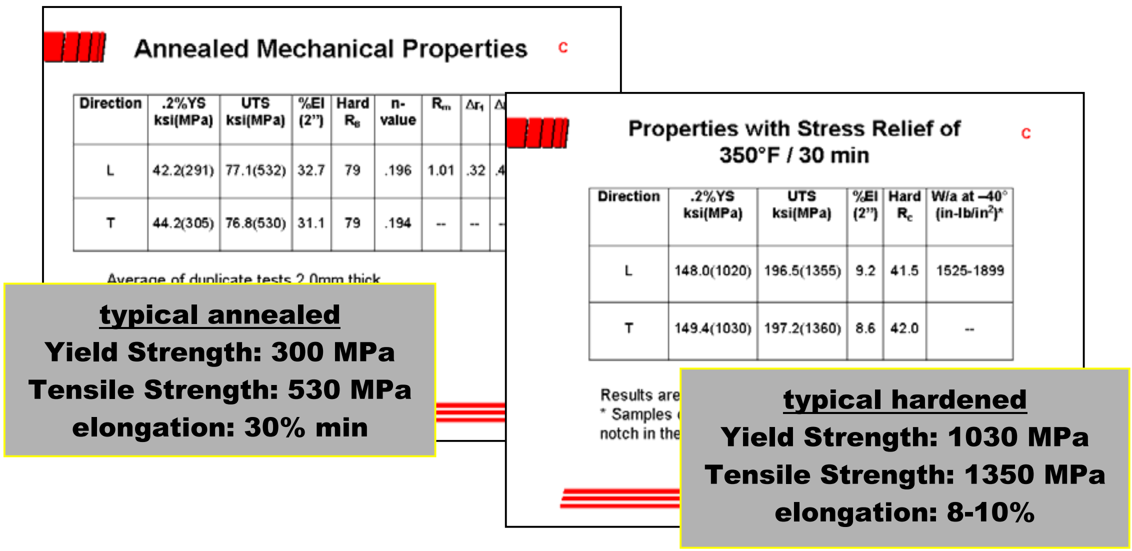
Component Relative Weights and Costs vs. low alloy steel (strength based-design)



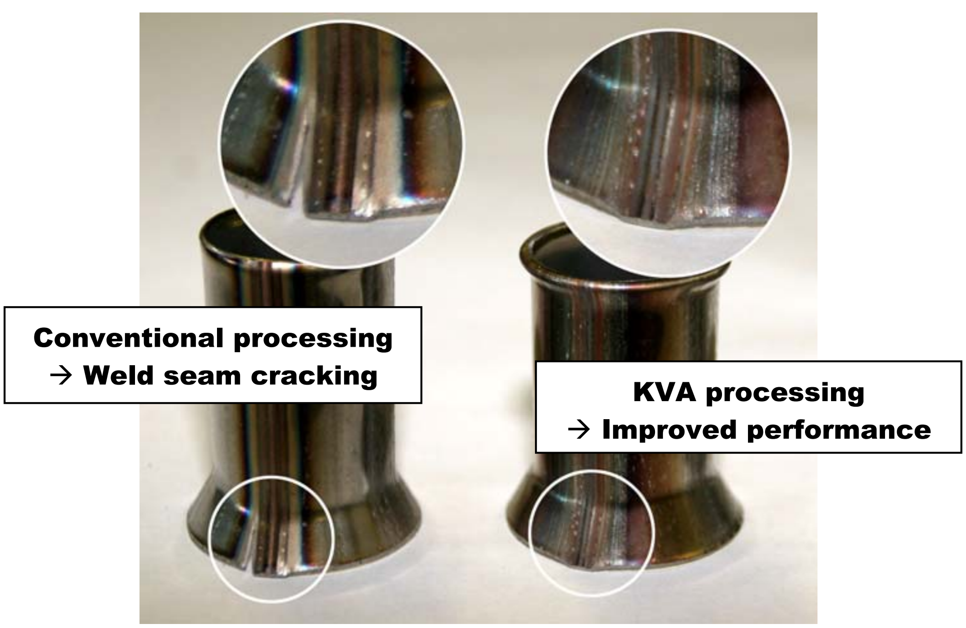


The important thing to note about the above charts is as follows: When a steel part is redesigned to take advantage of a high performance engineering material, namely to reduce weight while maintaining current strength levels, ***a part redesigned with KVA technology utilizing martensitic stainless steel can achieve a significant weight reduction and cost much less*** than other 'lightweight' metals.

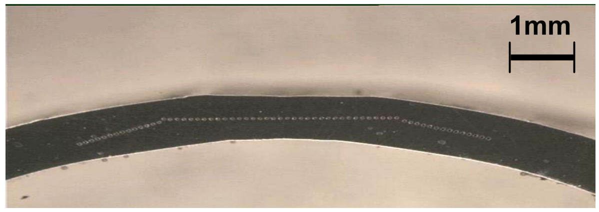
A key benefit of KVA technology is the ease of forming complex part geometries. The material can be ***readily formed in its softer, annealed state, with low force, low cost tooling***. Once the desired geometry is created, the parts can be heat-treated to a high-strength condition with low-cost thermal processing methods.



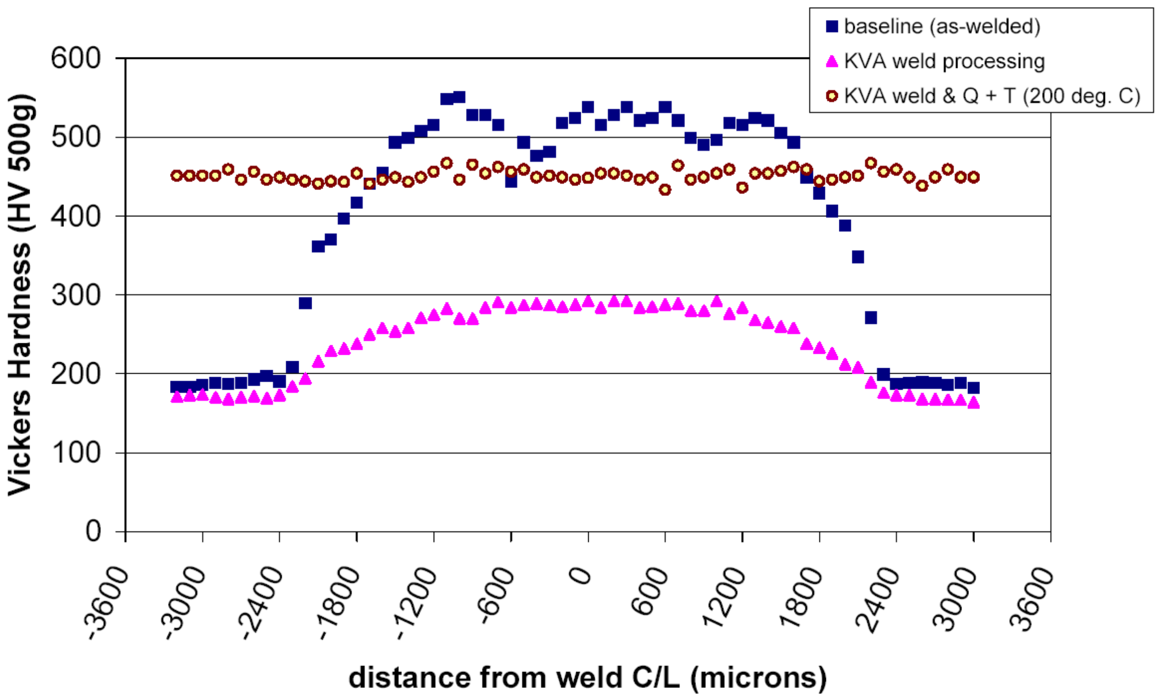
KVA's technology has overcome the conventional limitations of high-speed welding air-hardenable martensitic stainless steels. Previous difficulties, such as cold-cracking of the weld zone under mechanical straining and forming, have been eliminated. The following images demonstrate the improved weld-seam properties, from a macro-level to the microstructural level, that KVA processing enables.



Stainless seam-welded tubing: Conventionally processed and KVA processed



Seam-welded tubing microhardness test profile
Hardness spacing: 100 microns, load 500g



Seam-welded tubing microhardness test profile
Conventionally processed, KVA processed, Hardened

It is important to note that KVA seam-weld technology effectively reduces the hardness of the weld, in both the fusion zone and the heat-affected zone. This reduction in hardness, and associated improvements in ductility, toughness and formability, allows air-hardenable martensitic stainless steels to be used in welded applications historically considered impractical. In addition, KVA seam-weld technology does not limit the part from fully transforming into a homogenous, uniform microstructure after a solution heat-treatment. The base metal, heat-affected zone and fusion zone all reach uniform properties after hardening.

Photomicrographs (30x magnification) of Seam-welded martensitic stainless tubing
From top: Conventionally processed, KVA processed, Hardened

KVA stainless steels are ideal substitutes for boron-treated steels in hot stamping operations, or alternatively can be thermally processed with efficient, high throughput continuous furnaces or induction methods. The unique air-hardening property of KVA stainless allows for simultaneous hardening and brazing to be performed, with minimum distortion due to the slow cooling rates involved. The result is that martensitic stainless steels can now be used in a wide variety of structural applications, without significant cost increases.

Ideal applications for KVA technology include:

- Automotive structures
- Aviation structures
- Bridge structures
- Sports equipment
- Bicycle frames

Our efforts thus far have been concentrated on reducing weight - typically achieving a 30 to 45% mass reduction while maintaining or exceeding current strength levels - in automotive applications. We have been received very well and have completed several successful prototype fabrication and testing trials with better-than-expected mechanical, environmental and cost performance.

Sample KVA high-strength automotive prototypes

Sample KVA high-strength bumper beam automotive prototype

Ideal applications of KVA tubular/shelled welded martensitic structures in the automotive industry include:

- Removable chassis components (bumper beams, frame crossmembers, suspension control arms, subframes, etc.)
- Safety/Intrusion management components (side impact beams, roof bows, roof rails, B-pillars, etc.)
- Entire chassis frame rails
- Fuel/hydraulic lines
- Fuel injection rails
- Vehicle seat frames and supports
- Vehicle accessories (tow hooks, racks, running boards, etc.)

In summary, KVA has developed proprietary methods to produce welded and brazed tubular forms, stamped and shelled structures, using martensitic corrosion-resistant steels. High strength structural shapes can now be integrated into high performance structural assemblies to reduce weight, increase strength and stiffness, without significant cost increases. Entire assemblies can be heat treated to uniform microstructures and hardness/strength levels tailored to the individual application. Tensile strengths in excess of 200 ksi (1400 MPa) are capable from simple low-cost, air-hardening quench processes. Excellent mechanical properties, including specific strength and stiffness, toughness and fatigue performance, in addition to corrosion-resistance, can be achieved using martensitic stainless steels in place of other materials.

KVA is interested in aggressively pursuing production and licensing agreements to arrive at cost-effective, superior mechanical and structural solutions. If you would like more information, technical or otherwise, please contact us to further discuss KVA's enabling technologies.