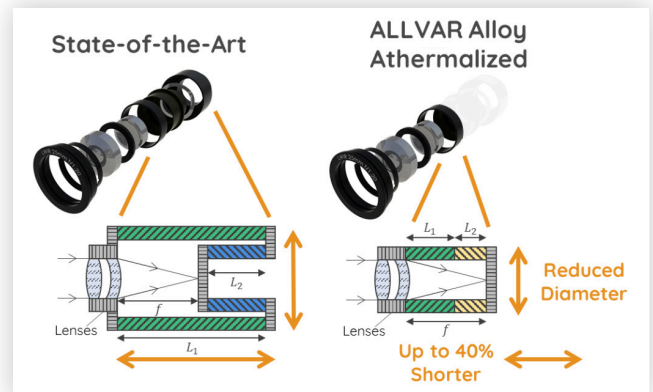




Spacers for Athermal Optics

Negative CTE, Positive Results.

ALLVAR Alloys are the only metals that shrink when heated and expand when cooled. This unique property, known as negative thermal expansion, enables optic manufacturers to athermalize their designs - creating smaller, lighter, and better performing optics that stay in focus regardless of temperature changes. For example, large and bulky tube-in-tube athermalizing assemblies, often required when using positive CTE materials, can be replaced using a single ALLVAR component to passively athermalize the systems.



Unlock Enhanced Optical Design with ALLVAR:

- Enable designer-specified thermal expansion between optic elements.
- Achieve zero thermal expansion at a specific operating temperature.
- Reduce optic length by up to 40%.
- Increase production yield up to 25% by relaxing tight assembly tolerances.
- Close the 5%-10% performance gap between CAD and build.
- Increase assembly stiffness by eliminating tube-in-tube systems.

Potential Optic Applications:

- Weapon and Helmet Mounted Optics
- Intelligence, Surveillance, and Reconnaissance
- Special Operations
- Space Systems
- Multispectral Imaging

About Negative CTE

ALLVAR Alloys are the only metals in the world that shrink when heated and expand when cooled, known as a negative coefficient of thermal expansion (CTE). Commercially available ALLVAR Alloy 30 exhibits an axial -30 ppm/°C CTE at room temperature.

Compared to Invar, Titanium-based ALLVAR Alloys are:

- More corrosion resistant.
- More shock resistant.
- Lower density.
- Easier and faster to machine.

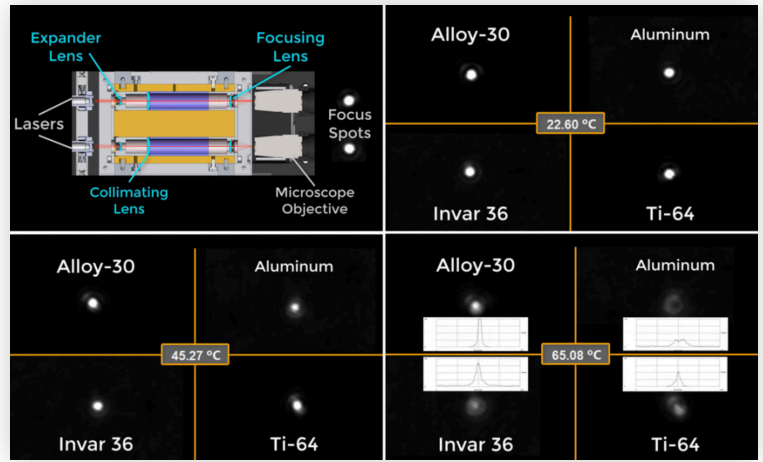
Compared to Carbon Fiber Reinforced Composites (CFRP), ALLVAR Alloys are:

- Insensitive to moisture.
- Safe and easy to machine.
- Lower cost and faster lead.

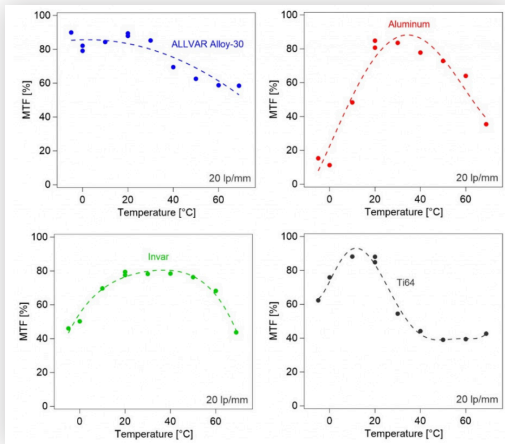
NEGATIVE THERMAL EXPANSION AT WORK:

While modeling and calculations are helpful, they pale in comparison to seeing actual results. To the right is an optic demonstrator that requires a negative thermal expansion material between two lens cells to maintain optimum focus. The demonstration compares the performance of ALLVAR Alloy 30 to other metals like Aluminum, Titanium, and Invar.

Looking at the image on the right, ALLVAR Alloy 30 maintains the best focus as the temperature increases from 29° to 65°C.



Scan QR code to watch the video of the experiment:



EXPLORING THE TECHNICAL DETAILS

For those that prefer more technical detail, shown to the left are the Modulation Transfer Function (MTF) values versus temperature for each image spot for the four materials tested. The Aluminum and Ti6Al4V (Ti64) show very sharp peaks associated with rapid drop offs in performance above and below an optimal operating temperature. The Invar shows excellent stability between 20°C and 50°C, but MTF drops off well below 60% above and below optimal operating temperature. The ALLVAR Alloy 30 material displays a much smoother response and excellent stability throughout with a small decrease from 85% MTF at -10 °C to 60% MTF at 70°C. ALLVAR Alloy 30 is an incredible tool for your engineering toolbox.

Would you like to try ALLVAR Alloy 30 in your optic design?

Request a copy of our SOLIDWORKS Material Definition file to start designing today. Take advantage of the tunable nature of ALLVAR Alloy 30 and solve focusing dilemmas today.

ABOUT ALLVAR

ALLVAR, founded in College Station, TX in 2014, manufactures revolutionary alloys with unique negative thermal expansion properties. These alloys help compensate and eliminate the detrimental effects thermal expansion causes in a variety of extreme environment applications that require high-performance. Negative thermal expansion alloys can be used to athermalize optic designs, reduce thermal stress in assemblies, maintain a constant force load, and maintain stability with thermal changes. ALLVAR's mission is to realize long term societal benefits by rapidly transforming the scientific novelty of tailored thermal expansion alloys into useful athermalization technology.

PARTNER WITH US

To advance the Technology Readiness Level (TRL) of ALLVAR Alloys in optics applications, the ALLVAR team is looking to collaborate with prime government contractors and system integrators to design, build, and test ALLVAR Alloy athermalized optic prototypes in programs of record.

Interested in smaller, lighter, and better performing fixed focus optics? Contact us to join the athermal optic revolution!

EXPLORE OUR RANGE OF PRODUCTS

Currently, we offer our Negative Expansion ALLVAR Alloys in Bar (up to 2.25" round) and tube (up to 3.00" OD). ALLVAR offers custom components including lens spacers, optical barrels, and struts machined by our vetted machining partners. We also offer thermal compensating washers and spacers to maintain constant pre-loads to control the margin of safety of bolted joints and lens stacks.