New Developments in Allvar Alloys

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Introduction

Anisotropic
Potential Application Areas

- Infrared Optics
- Satellites
- UAV Optics
- Lasers
- Industrial
- Extreme Environments
Example Athermal Problem

### Thermal Stabilizing Rings

- [Image of thermal stabilizing rings]

### Single Stabilizing Ring

- [Image of single stabilizing ring]

### Temperature vs. Focus Shift

- Graph showing the relationship between temperature and focus shift (Thermal Focus Shift)

- The graph indicates a negative correlation between temperature and focus shift.
Alloy 16

Room Temperature

Aluminum
Material Development

Alloy 16

- CTE vs. Temp
- CTE vs. CTE Slope

Alloy 16
Mechanical Properties

Invar

\[ \sigma_{\mu y} = 70 \text{ MPa} \]
A New Design Paradigm

\[ \alpha_{tot} = \frac{L^o_{AV}}{L^o_{tot}} (\alpha_{AV} - \alpha_{Other}) + L^o_{tot} \alpha_{Other} \]

\[ \frac{L^o_{AV}}{L^o_{tot}} = \frac{\alpha_{tot} - \alpha_{Other}}{\alpha_{AV} - \alpha_{Other}} \]

Other Metal

ALLVAR

\[ L_{Total} \]

\[ L_{Other} \]

\[ L_{ALLVAR} \]
Welding

Graph showing stress vs. strain for different weld types:
- Seam Corrected
- Ti64
- ALLVAR Alloy 16
- Bevel Weld
- Seam Weld

Approximately 25% decrease in stress.
Other Component Geometries

[Diagram of component geometries with measurements and plots showing CTE at 0°C and CTE slope vs. radius for ID and OD]
Conclusions

Other Metal  ALLVAR

$L_{\text{Total}}$

$L_{\text{Other}}$  $L_{\text{ALLVAR}}$

Images of various materials and equipment.
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