



TECHNOLOGY SOLUTION

Mechanical and Fluid Systems



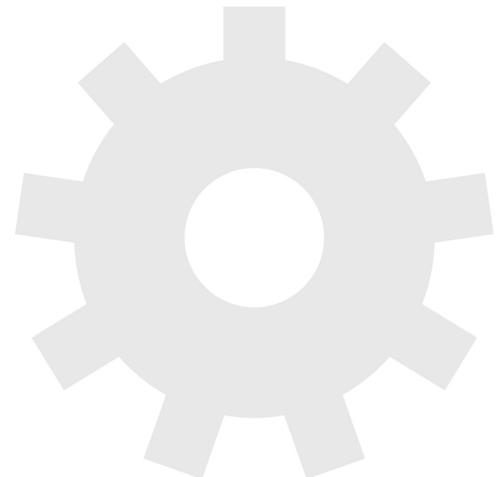
High-Temperature Single Crystal Preloader

Advanced single crystal spring preloaders maintain resiliency in excess of 2000°F

Many aerospace vehicles require thermal barriers/seals to minimize the flow of hot gases through interfaces in thermal protection systems and propulsion systems where temperatures can exceed 1200°F. One of the primary challenges is maintaining proper sealing contact at elevated temperatures. To address this challenge, preloading elements in various spring-like forms are often incorporated into or behind a seal to provide the required resiliency. At these elevated temperatures, conventional spring preloaders made from polycrystalline alloys lose strength and can exhibit excessive creep, resulting in a loss of sealing contact. Glenn innovators have developed new processes to enable the fabrication of preloaders made of single crystal superalloys that can increase the upper limit of thermal seals to greater than 2000°F for short to moderate term applications, and greater than 1800°F for long term applications. These preloaders can be manufactured in a variety of configurations allowing stiffness to be customized for a particular application.

BENEFITS

- Versatile: Single crystal preloaders can be fabricated in a variety of geometries using different manufacturing methods
- Effective: The combination of single crystal alloys & unique preloader designs offers potential for significant advancement over current state of the art
- Robust: The single crystal preloader maintains resiliency at temperatures greater than 2000°F for short term applications

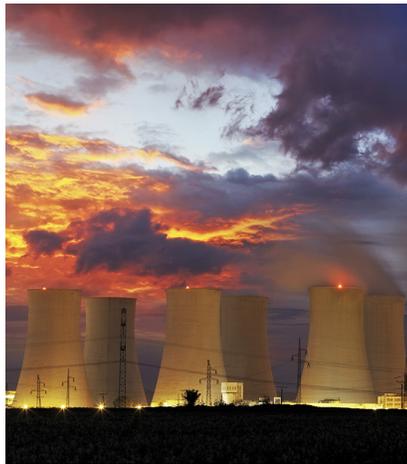


THE TECHNOLOGY

For extremely high-temperature sealing applications, Glenn researchers have devised novel methods for fabricating single-crystal preloaders. NASA's high-temperature preloaders consist of investment cast or machined parts that are fabricated in various configurations from single crystal superalloys. Machined preloaders include a variety of spring configurations, compressed axially or radially, fabricated from single crystal slabs. Before machining, the slabs are carefully oriented in a special goniometer using x-diffraction techniques. This helps to maintain proper crystal orientation relative to the machined part and the applied loads. For more complex geometry components which cannot be easily and economically machined, an investment casting approach would be used. Complex preloader geometries include wire coil springs of various configurations. These single crystal preloaders would be designed with the appropriate stiffness for the intended thermal barrier/seal application and placed underneath, or integrated within, the seal/barrier. At extremely high temperature, the preload device keeps the seal/barrier mated against the opposing surface as the gap between the two surfaces changes, maintaining contact between surfaces and preventing convective heat transfer.



Glenn's single-crystal preloaders can help seal joints and doors in industrial furnaces



Glenn's single-crystal preloaders can be used in power generation applications

APPLICATIONS

The technology has several potential applications:

- Aerospace systems
- High-temperature manufacturing
- Industrial furnaces
- Power generation
- Oil & gas
- Chemical & material processing

PUBLICATIONS

Patent No: 9,541,148; 10780514