

METAL CASTING

Success Story



META-LAX[®] STRESS RELIEF PROCESS

Meta-Lax Stress Relief Process Greatly Reduces Energy Consumption and Eliminates Pollution

Benefits

- ◆ Reduces energy consumption by up to 98% compared with natural-gas-fired heat treatments
- ◆ Through 2001, has saved 98.7 trillion Btu cumulatively
- ◆ Operates on standard line voltage
- ◆ Through 2001, has saved over \$342 million from reduced natural gas usage
- ◆ Requires nearly 98% less time for stress relief
- ◆ Through 2001, has reduced carbon emissions by over 1.57 million tons.
- ◆ Reduces production costs and weld cracking by approximately 95%
- ◆ Offers comparable or better work-piece performance than thermally stress-relieved parts
- ◆ Is portable and lightweight for on-site treatment
- ◆ Has no part size or weight limitations

Applications

Metal fabrication and machining industries; applicable to castings, forgings, weldments, and metal plates.

"The DOE grant has given us credibility, to a certain extent, away from being an unknown, unendorsed company, that just created a better mousetrap."

— Tom Hebel
Vice President
Bonaf Technologies, Inc.

It's nearly impossible to go through an entire day without coming in contact with an item that was produced from metal tooling. The cars we drive, the appliances we use, and the water heaters that warm our homes are all manufactured using metal tooling. The manufacturers of these products rely heavily on tooling for manufacturing quality products. And, consumers expect these products to last.

Items that have been manufactured through fabricating, forging, casting, or machining are typically stress-relief treated to ensure that the metals hold up under the pressure of daily wear and tear. Thermal stress is the result of a sharp temperature drop during metal processing and it can create distortion and premature cracking. "Stress relieving" reduces these problems. However, the most common method of heat-treatment stress relief has problems of its own. It is costly, both in terms of time and energy. It may take hours or days to treat metal items in a furnace, and those hours and days of furnace time equal large amounts of fuel that must be burned.



Meta-Lax Stress Relief Process in use by the U.S. Army



Technology Description

With a grant from the U.S. Department of Energy's Inventions and Innovation Program, Bonal Technologies, Inc., has created and patented the Meta-Lax process, which relieves thermal stress within metal components by using nondestructive, highly efficient subharmonic vibrations to prevent distortion and cracking. The 1989 grant gave Bonal Technologies the chance to refine and prepare its process for the marketplace, including third-party documentation.

In the Meta-Lax (metal relaxation) process, the operator clamps a force inducer (vibrator) onto the object and, using instrumentation that measures vibratory amplitudes of the atomic lattice, determines the present harmonic frequency curve. The curve represents the "false" harmonic frequency of the stressed metal. After the force inducer vibrates the metal for about 20 minutes at a frequency corresponding to one-third of the height of the stressed harmonic amplitude, the harmonic frequency permanently shifts. The new curve is a true reading, indicative of the metal's nonstressed state.

Meta-Lax is a proven substitute for 80% to 90% of heat-treatment stress relief in metal-working applications. It improves the inconsistencies of the previous resonant-vibration technology by using more efficient, more consistent "subharmonic" vibrational energy, which is the optimum vibration stress-relief frequency. This process treats a wider variety of work pieces with a versatile, portable unit and yields results much more quickly than conventional, stationary heat-treating furnaces. Conventional heat treatments may require over 6 hours while the Meta-Lax process requires an average of about 30 minutes.

System Economics and Market Potential

The Meta-Lax process was commercialized in 1991, and approximately 1300 units are currently operating in the United States. Payback time is estimated to be from 6 to 9 months. The Army reports a \$230,000 annual return on its investment in this technology.

Bonal Technologies develops subharmonic vibrational metal stress-relief and weld-conditioning technology. Bonal Technologies employs 23 people and has annual sales of approximately \$2 million.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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