KomTeK
A Division of Kervick Enterprises

TÜV CERT ISO 9002

40 Rockdale Street • Worcester, Massachusetts, 01606 • (508) 853-4500 • FAX (508) 853-2753

January 20, 2000

Mr. Craig Blue
Oak Ridge National Laboratory
PO BOX 2008 MS6083
Oak Ridge, TN 37831-6083

Dear Craig,

As a component of the Cooperative Research and Development Agreement (CRADA) No. ORNL 98-0512 titled, "Controlled Nonisothermal Hot Forging using Infrared For Microstructural Control and Energy Savings," KomTeK has started evaluating a portable die block heater. This system was designed and constructed by you and your staff to evaluate the benefits or drawbacks of using such a system to preheat forging dies inside a forging hammer. We have been using the system for approximately 1 month. In our evaluation we are considering both the short and long term benefits provided by using the system. I would like to summarize a few of our initial observations concerning the short-term benefits.

System Design and Ease of Use

Some of the key issues to implementing any new type of technology in a production setting like a drop forging operation are ruggedness and simplicity of use. The system we are evaluating has worked flawlessly from the day it arrived. The feedback control system has proven itself to be repeatable and allowed us to keep consistent die heat over the course of a production run. The heater is being used to initially heat the blocks at the start of a shift, and then during breaks. The hammer operators have become very comfortable and confident in the use of the die heater, despite their early reservation for how robust it may be. Those initial concerns have been allayed.

Productivity and Energy Savings

Last year Komtek experimented with gas-fired infrared heating. We determined that some of our forgings could only be reliably produced with die faces preheated to 400°F. These infrared heaters needed approximately 4 hours to heat the die faces to this temperature. The same blocks with the quartz infrared system you developed did the same job in 20 minutes (Ref. KTK P/N 80025F). The benefits of this type of improvement are clear. Eliminating 3.5 hours from the heat-up time is a significant improvement.

Die heating in the past has been conducted by placing heated pads of steel between the die blocks. These blocks are heated in furnaces to temperatures between 1500 and 2000°F. By eliminating these pads, we no longer need to heat an entire furnace to heat these pads. Heat is only applied when needed, with no additional heat-up time required.

Quality

While using pad heaters this has been a convenient method for years, it is in most ways an improper method due to overheating of the die faces, and underheating of the die impression cavities. Use of these pads inherently generates non-uniform temperature gradients on the die block surfaces, and does not provide sufficient heating to the cavity areas where it is most needed.

Use of the infrared heater produces uniform heating via line-of-sight radiation. Hence, all cavities and surfaces are heated uniformly since there is no backdraft in die blocks. This uniform, predictable and reliable heating to a controlled temperature has allowed us to provide more repeatable dimensional stability to our forgings. We placed the die heater on a set of die blocks heated by the pads and used the temperature measurement system to establish that the heating pads only raised the cavity temperatures to between 90-100°F. Use of the quartz infrared heater for the same period of time provided the consistent 400°F temperature across the entire surface of the die face.

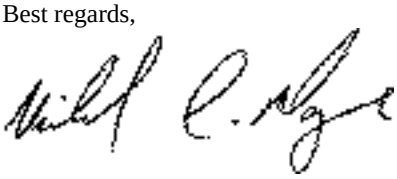
Thermally induced changes to dimensions of die blocks can contribute to loss of match across parting lines (front to back and side to side). We have observed that by using the quartz infrared die heaters that our die temperature is more uniform and we observe less variation in parting line match problems.

Longer Term Benefits

We are currently evaluating a longer-term benefit of the heater as it relates to die wear. By providing a hotter die face, we extract less heat from the metal being forged. As a result, the flow stress stays lower between successive blows, eventually ending with higher finishing temperatures. We would anticipate that this would decrease the amount of die wear, thus increasing the life of the die. It should take us approximately another month of production to make a reasonable assessment of this potential benefit. Another potential long term benefit from the system is that the decreased variation in match will extend the life of our trimmers since they will not be having to trim through as much material.

In short, we are extremely pleased with results of the system and the way that you have implemented the concept in the hardware you produced for evaluation. If you have any questions, please feel free to contact me at 508-853-4500.

Best regards,



Michael C. Maguire, Ph.D.
Vice President, Product and Process Development