

A FLEXIBLE HEAT-TREATMENT METHOD WITH SURPRISING EFFECTS

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ABSTRACT

When designing new materials and alloys, there exists a technology that has not yet been widely utilized. A specifically designed HIP equipped with Uniform Rapid Quench (URQ™) or Uniform Ultra Rapid Control (U²RC™) can perform heat treatments that are almost impossible to do in any other way, both referring to complexity and repeatability. Also, it can lower the thermal stresses by an order of magnitude or more compared to commercially available heat treatments. These properties are particularly well suited for PM-parts. This paper will describe reasons why these differences occur. The result is the possibility to create new and better materials and alloys, and such new developments will be presented in this paper. It will also touch on the improved productivity of the latest generation of HIP equipment (up to three full HIP cycles in an 8 hour shift), and a new standard U²RC™ series.

INTRODUCTION

When designing a heat treatment system there are a number of characteristics that are desirable to achieve, these include:

- A good temperature accuracy
- The possibility to perform many successive temperature steps, preferably without moving the load
- A design that can easily change between one temperature cycle to another in full production
- A rapid temperature change rate, in particular when decreasing the temperature
- A broad available temperature span, i.e. being able to run either 150°C (300°F) cycles or 1350°C (2460°F) simply depending on how the heat treatment cycle is programmed
- A clean process that is environmentally friendly that does not contaminate the load or requiring washing afterwards
- Allowing complicated shapes to be processed.
- Allowing blind end holes to be drilled before heat treatment
- Keeping thermal stresses low.
- The equipment should be large enough to run production parts (not just laboratory sizes)
- A system that is relatively insensitive to how the treated parts are positioned
- A high heat transfer coefficient
- An evenly distributed heat transfer coefficient

Normally all of these characteristics on the designer wish-list cannot be achieved in one design, so an acceptable compromise has to be used.