How to Avoid Coloring of Parts in Hot Isostatic Pressing for MIM

Dr. Anders Eklund, Quintus Technologies AB anders.eklund@quintusteam.com
Mr. Magnus Ahlfors, Quintus Technologies AB magnus.ahlfors@quintusteam.com

- Hot Isostatic Pressing
  - Basic info
    - Combining high temperature and isostatic pressure
    - Definition
      - Applying a pressure, absolutely higher than the yield stress of the material at the HIP temperature
  - Disadvantages of conventional HIPing
    - Difficult to heat up
    - Difficult to cool down
    - Difficulty in controlling temperature and pressure
    - High risk of thermal shocks
    - Low efficiency in heat transfer

- Heat Treatment in HIP
  - Recent developments in HIP equipment
    - URQ® – Uniform Rapid Quenching
    - Possibility to perform quenching in a HIP
  - Advantages of heat treatment in HIP
    - Lower scattering of material properties
    - Improved fatigue properties
    - Improved ductility
    - No risk of decarburization of the component surface

- HIP for MIM
  - As sintered MIM parts
    - Relative density after sintering is (88-92.88%)
    - Residual porosity gives lower mechanical properties
      - Large effect on fatigue limit and fracture toughness

- HIPing of MIM parts
  - Discoloration of MIM parts
    - Extra steps in post HIPing, e.g. cleaning, polishing, etc.
  - HIPing of MIM parts
    - Discoloration of High-Chromium parts
      - May require additional cooling steps and then introducing thermal stresses again
      - Can also change surface composition
      - Colors can be blue, yellow, black, green, or cyan

- Summary and Conclusion
  - Inert atm.
gas as pressure medium
  - No risk of decarburization of the component surface
  - Continuous cooling of the gas from the same elevated temperature as the component
    - Low thermal gradients
    - Low risk of distortion and cracking
  - Flexible heat treatment
    - User-friendly process with infinite many holding, heating, quenching and cooling steps
    - Optimum HIP system to avoid discoloration of MIM parts with high-Cr content
  - And of course the regular benefits of HIP
    - Improved ductility
    - Improved fatigue properties
    - Lower scattering of material properties

More information on www.quintustech.com/hot-isostatic-pressing