Rapid Preheating of Extruded Aluminum Billets for Energy Efficient Production of Forgings

Goal
- Increasing the energy efficiency of preheating and post-process heating of aluminum billets for the forging industry

Development
- Developed a Super Energy Efficient Furnace (SEEF) for heating aluminum billets
  - Hybrid infrared system enables rapid heating
  - Rapid preheating prevents grain growth leading to greatly improved mechanical properties
- Validated the new furnace system on a forging shop floor by preheating and processing over 2,000 billets of aluminum (1.3 kg/billet)

Benefits
- SEEF overall efficiency is ~30% (Conventional convection furnace is ~ 10% efficient)
- SEEF drastically reduces the time to preheat billets (Conventional 6 hrs; Infrared 18 minutes per unit billet)
- It also improves energy efficiency of heat treating aluminum parts (Conventional heat-treating furnaces take 10hrs; SEEF takes ~ 1hr per unit billet)
- Estimated potential national energy savings up to 0.8 Trillion BTU/year for Aluminum forgings (plus similar savings for Cu, Brass and Ti for a total ~ 1.6 Trillion BTU/yr)).

Applications
- Forging
  - Preheating of extruded billets (Al, Ti)
  - Heat-treating of forged parts (Al, Ti)
- Heat treating
  - Annealing, normalizing
  - Stress Relieving
  - Solutionizing
- Joining Industry
  - Preheating and post weld annealing

Additional R&D
- Investigate other aluminum alloys, brass, copper, and titanium for evaluation of full market penetration
  - Preheating and heat treating
  - Properties of alloys

Project Partners

Research and Development Sponsored by
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In plant trial with new rapid heating furnace