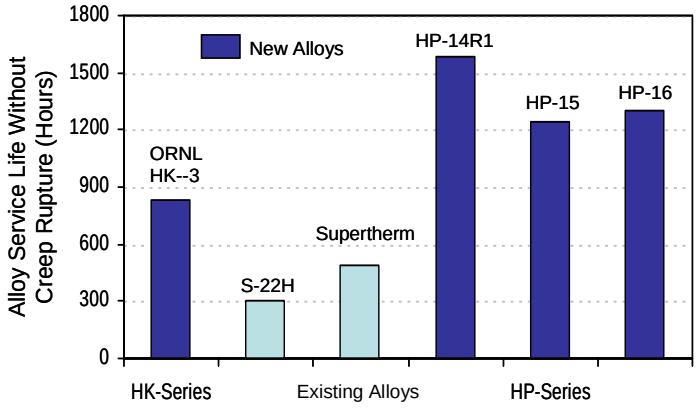
Designer Stainless Steels Can Take the Heat

Several new, H-series stainless steels that offer increased process efficiencies for multiple energy-intensive industries have recently been developed, through funding from the Department of Energy's EERE Industrial Technology Program's Materials portfolio. These new cast austenitic stainless steels use inexpensive alloying additions to increase the steels' functional temperature range by 50 ^{o}C over that of conventional alloys; and to extend their service life by 65 to 150 percent (see inset). The collaborative R&D team, led by Duraloy Technologies, Incorporated, achieved these improvements by using microstructure design tools developed at the Oak Ridge National Laboratory. The steel, chemical, and heat-treating industries will directly benefit from this cost-shared project. Applications include reaction tubes, radiant burner tubes, rolls and reaction vessels for over one hundred reformers (ammonia, methanol, hydrogen etc.) and heat treating systems. The new technology is expected to result in over 35 trillion Btu in energy savings by 2025.



New HP Alloys Extend Service Life By More Than 150%

Based on fixed test temperature of 2,200° F and stress of 500 psi.

Superior toughness and corrosion resistance helped make HP and HK austenitic grades the most commonly used stainless steels for high-temperature applications. After undergoing incremental improvements for the past 80 years, these steels had reached a plateau in performance. To further enhance durability and boost productivity, experts at ORNL abandoned trial-and-error for a more deliberate design approach. The precise microstructures of various alloy compositions were characterized, and multi-phase computational modeling was used to predict associated material properties and thermal performance. Project partners then cast and tested the most promising compositions to verify the predictions.

Patent applications have been filed for one HK alloys and are being prepared for one of the HP alloys. Duraloy Technologies has melted the HP alloy in 1,000-pound heats and cast it into thin-walled tubes. That alloy has now been used in a radiant burner tube assembly which has operated successfully for over eight months in a steel production furnace. This demonstration has stimulated broad interest among steel, petrochemical, forest products, and heat-treating companies. Applications under discussion include carburization furnace tubes and hydrogen reformers. Other potential applications extend to transfer rolls, tubes for ethylene and other chemical processing, and coiler drums and rolls used in Steckel mills for steel processing.

This successful ITP project drew on the talents of a collaborative R&D team under the direction of Duraloy Technologies. Members of the team include Bethlehem Steel,

Energy Industries of Ohio, Harper International, IPSCO, NUCOR Steel, Oak Ridge National Laboratory, and the Timken Company. A fact sheet on the project is available at www.eere.energy.gov/industry/imf/pdfs/duraloy_h_series.pdf

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