Super 9 Chrome Alloy: Higher Strength Metal Boosts Power Plant Performance

All power generation engineers share at least one common aim: improve the efficiency of their boilers. During the 1980's, a new metal alloy developed in the Department of Energy advanced materials program gave engineers a way to increase efficiency. Today, *Super 9 Chrome* , a super-strong steel alloy, is the worldwide industry standard for safer and more reliable coal-fired power plants.

The metal is used for superheater tubes, pipes, and forgings. With code approval of this new alloy, it became possible to increase a power plant's operating steam temperature from approximately 1005°F to 1075°F and, at the same time, extend the life of power plant equipment. The higher operating temperatures allowed power plants to boost efficiencies by three to five percent - a significant increase in power plant performance, cost savings, and environmental protection.

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For example, a 500-MWe power plant operating at 38 percent efficiencies will burn nearly 111,000 tons of coal less each year than the same plant operating at 35 percent efficiency. That translates into a cost savings of $1.8 million per year in fuel costs and a reduction of carbon dioxide emissions by 280,000 tons per year. An Oak Ridge National Laboratory study has confirmed more than $200 million in sales resulting from the DOE investment in this advanced material.

Toughened Ceramics

Ceramics - glass-like materials capable of withstanding very high temperatures - can be toughened against fracture by adding whiskerlike fiber reinforcements that act like steel reinforcing bars in concrete.

Such strong, durable ceramics markedly improve the energy performance characteristics of equipment used in a wide variety of high-temperature applications, ranging from automobile, airplane and heavy-duty engines, to industrial applications, combined-cycle power plants, and oil refineries.

Although toughened ceramics are now widely used, the road to commercialization was filled with stumbling blocks. In the early stages of development, toughened ceramics suffered from brittleness, unreliable strength, and poor resistance to extreme changes in temperature. Despite these problems,