

# NASA TECH BRIEF

## *Lewis Research Center*



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### A Protective Coating for Stainless Steel

A protective coating has been developed to provide high temperature oxidation and erosion resistance for stainless steel. Based on a comparison of furnace oxidation tests, the protection afforded is equal to or greater than that provided by similar commercial coatings applied to highly alloyed steels and nickel alloys. The development of this coating for stainless steel is an outgrowth of previous work on coatings for superalloys and alloyed steels.

The coating is applied in a two-step process. The first step is a relatively economical flame spray deposition of a 0.127 mm thick layer of an 80% nickel - 20% chromium alloy on 304 stainless steel (18% chromium, 8% nickel). This layer is then converted to a chromium-containing nickel-aluminide by a pack cementation process (see Note 1), which also assures a complete diffusional bond. Cyclic furnace oxidation tests at both 1366°K and 1255°K have shown that this new coating offers protection equal to or exceeding that of other similar coatings which were evaluated by less severe tests. When heated to 1311°K for 10 minutes, then 922°K for 5 minutes, and then 1311°K for 10 minutes, this new coating system showed no significant loss of protection during 308 testing cycles, and still exhibited useful remaining life upon metallographic examination.

#### Notes:

1. Pack cementation process: The following mixture is deposited on the stainless steel substrate which has a prior flame spray nickel-chromium coating:

96% aluminum oxide  
2% aluminum  
1% sodium chloride  
1% ammonium bifluoride

In 16 hours at 1144°K, this pack deposits approxi-

mately 15 mg/cm<sup>2</sup> of aluminum which reacts to form the chromium enriched nickel aluminide intermetallic protective layer on the Ni-20Cr coated 304 stainless steel.

2. The following documentation may be obtained from:  
National Technical Information Service  
Springfield, Virginia 22151  
Single document price \$3.00  
(or microfiche \$0.95)

Reference: NASA TM-X-2201 (N71-17889).  
Exploratory Studies on Modified Aluminide  
Coatings for Low Carbon and Stainless Steel

3. Technical questions may be directed to:  
Technology Utilization Officer  
Lewis Research Center  
21000 Brookpark Road  
Cleveland, Ohio 44135  
Reference: B72-10256

#### Patent status:

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