Alloy 126 Oxidation Tests
Procedure and Results
(marketed as Chromel® 126)

Alloy 126 is a patented composition originally developed by Hoskins Manufacturing Company and now owned by Concept Alloys, Inc. and marketed as Chromel® 126. It was developed for use as the sheath material in Hoskins 2300 MI mineral insulated cable. Since Concept Alloys does not produce mineral insulated cable, the alloy is offered in tubing form, as well as rod and wire, for the production of MI cable by others, or other applications such as thermocouple protection tubes and continuous annealing tubes. In rod and wire or other forms it may find use in other applications that require excellent oxidation resistance at high temperatures such as resistance heating elements.

To demonstrate the performance of Alloy 126 relative to competitive alloys, a series of oxidation tests were performed. The initial test compared Alloy 126 to samples of Hoskins Chromel-A and Kanthal's Nikrothal 80 (both 80/20 nickel-chrome alloys) at 2000°F for approximately 2000 hours. The test samples were in rod form. The samples were held in an electrically heated furnace with an air atmosphere. They were removed each weekday and weighed to determine weight gain, due to oxidation, and weight loss, due to spalling of the oxidized material. Results reported in weight gain or loss, in milligrams per square millimeter of surface area, are shown in Table 1.

It is clear from the chart that the Alloy 126 samples gained a bit of weight initially due to oxide formation then held virtually unchanged (with only slight weight loss) for the duration of the 2000 hours test. Conversely, both 80/20 alloys gained substantially more initial weight, then lost weight, due to oxide spalling, consistently for the duration of the test.

Since the Alloy 126 was designed for use up to 2300°F and showed virtually no changes from exposure at 2000°F it was decided to conduct additional testing at 2300°F. Alloy 126 rod was compared with a rod sample of Nikrothal 80 and three samples of competing high temperature alloys in the form of mineral insulated cable at 2300°F.

After the first 50 hours of test it was apparent that two of the samples were completely compromised (see photos of Inconel 617 and Hastelloy C276). They were withdrawn from the test. The samples of Alloy 126, Nikrothal 80 and Pyrosil D continued until failure of the Pyrosil at about 500 hours. The weight gain is again reported in Figure 2 as micrograms per square millimeter. It should be noted that this weight comparison is biased since only the outer surface area of the Pyrosil is considered in the calculation. However, metallographic examination of transverse sections (Figures 8 through 10) is clearly indicative of the superior performance of the Alloy 126.

The third series of oxidation tests compared Alloy 126 to five samples of high temperature competitive alloys currently used for sheath materials in mineral insulated thermocouple cables. These included Hastelloy X, Haynes 230, Inconel 625, Inconel X-750 and Hastelloy HR-160. At the suggestion of a major supplier of MI thermocouple cable this test was conducted at 2200°F, the normal recommended upper limit for several of these competitive alloys.

As expected, Alloy 126 again showed superior performance compared to the competing alloys at 2200°F. As can be seen in Table 1, three samples of the initial samples, including Hastelloy X, Inconel 625 and Inconel X-750, were removed from testing due to severe oxidation. Weight gain or loss for the remaining three alloys is presented in Figure 3.

In summary, Alloy 126 exhibited oxidation resistance far superior to any of the other tested alloys at all three test temperatures.

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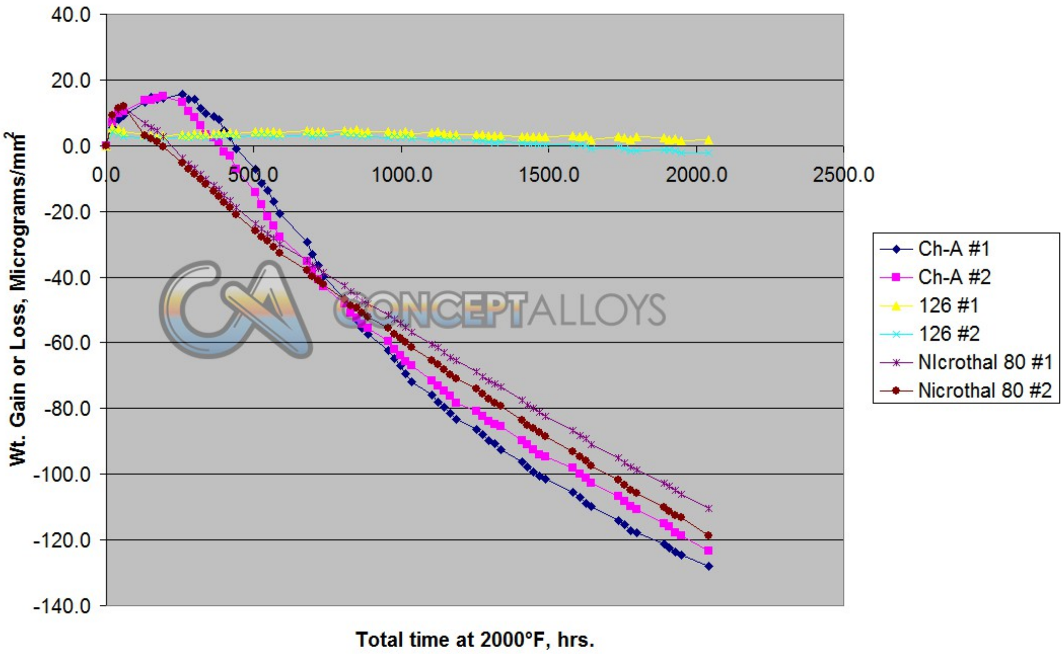

Figure 1 - Wt. Gain in Micrograms/mm^2

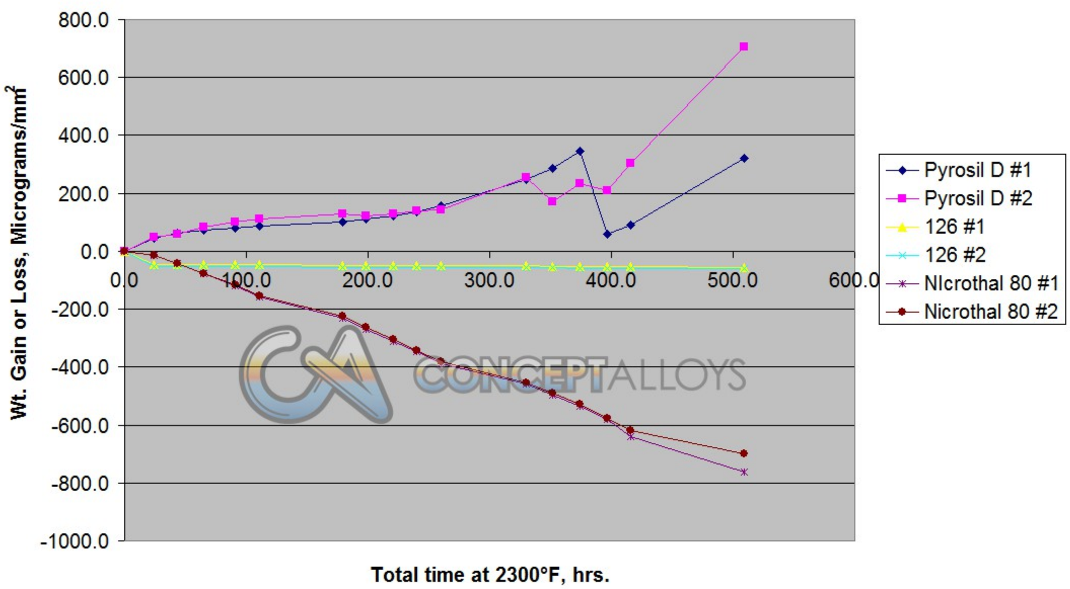

Figure 2 - Wt. Gain in Micrograms/mm^2 at 2300°F.

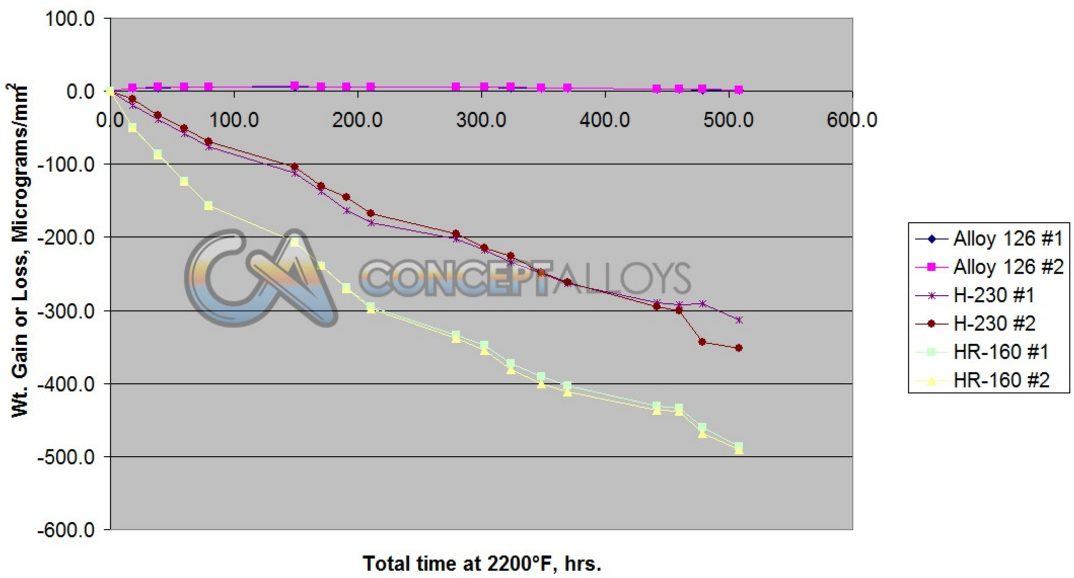

Figure 3 - Wt. Gain in Micrograms/mm^2

Alloy	Temp.	Total Hrs.	Wt. Gain Average @ 500 hrs. (µgm/mm^2)	Start Dia. (in.)	Percent Diameter Loss (%)
Chromel 126	2000	2000	3.7	0.2179	0.6
Nik 80	2000	2000	-24.9	0.2581	3.3
Ch-A	2000	2000	-10.8	0.1581	3.6
Chromel 126	2200	500	1.7	0.2179	0.8
HR-160	2200	500	-488.6	0.2368	6.5
H-230	2200	500	-332.0	0.2525	7.4
Hast X	2200	170	N.A.	0.2507	100.0
Alloy 625	2200	80	N.A.	0.2536	100.0
Inconel 750	2200	80	N.A.	0.2723	100.0
Chromel 126	2300	500	-58.3	0.2179	0.6
Nik 80	2300	500	-730.1	0.2581	13.7
Pyro D	2300	500	512.5	0.2500	0.9
Hast C276	2300	24	N.A.	0.2510	100.0
Inconel 617	2300	24	N.A.	0.2508	100.0

Table 1 - Oxidation Test Summary

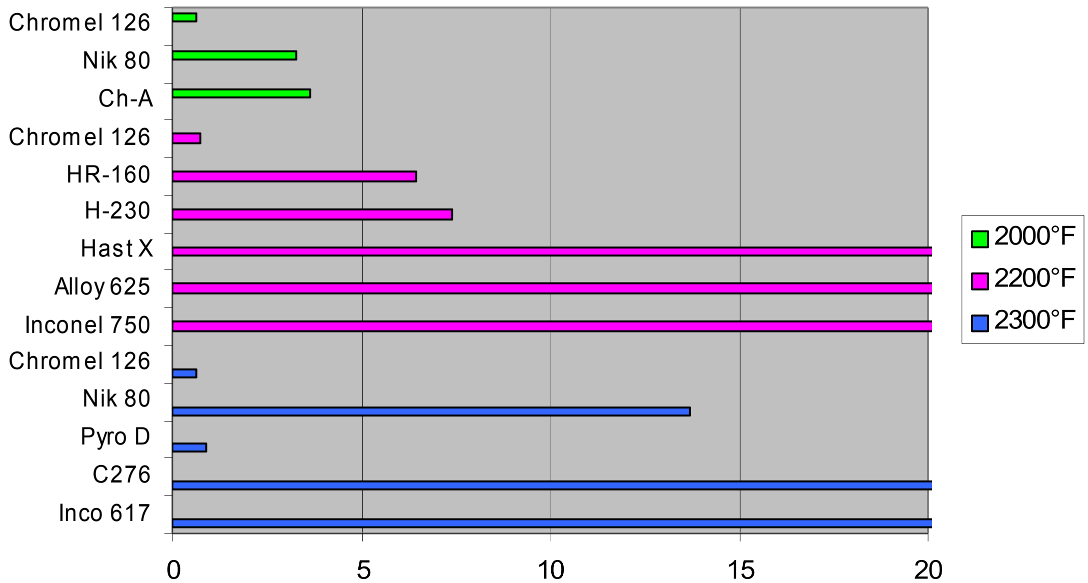

Figure 4 - Diameter Loss, % Dia.

Figure 6

Figure 7

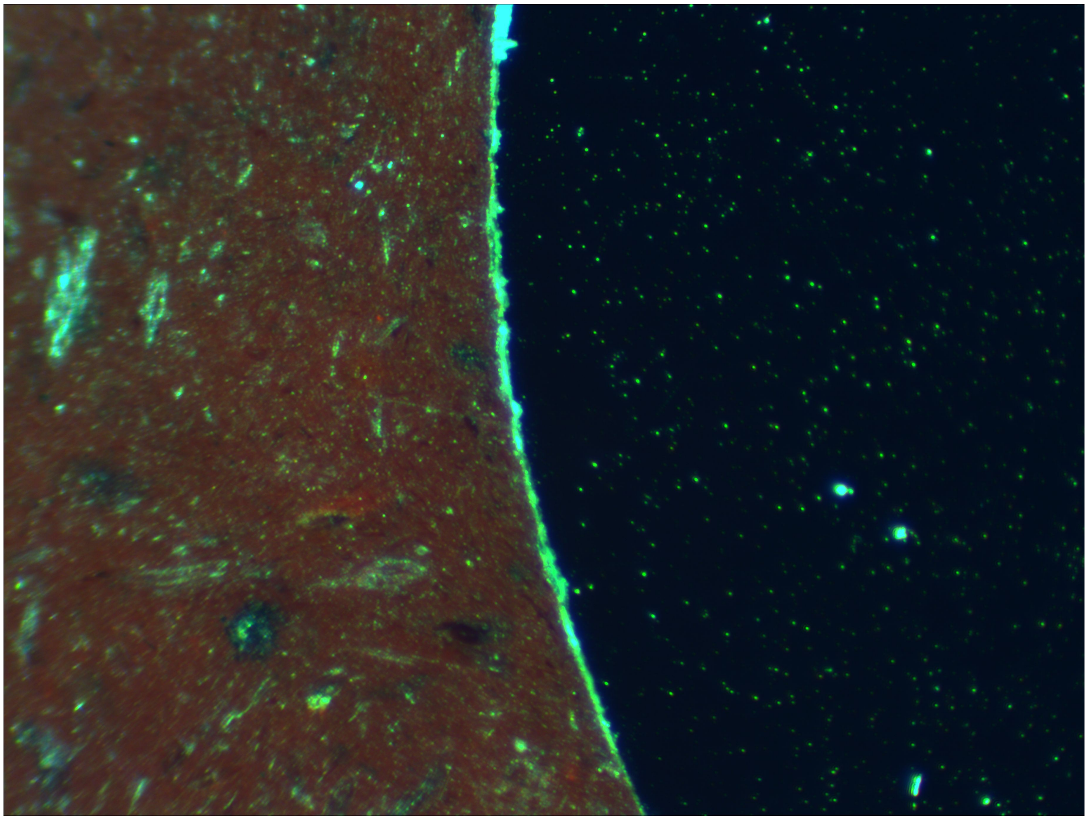

Figure 8
Alloy 126, 2300°F, 500 hours, photographed at 45X

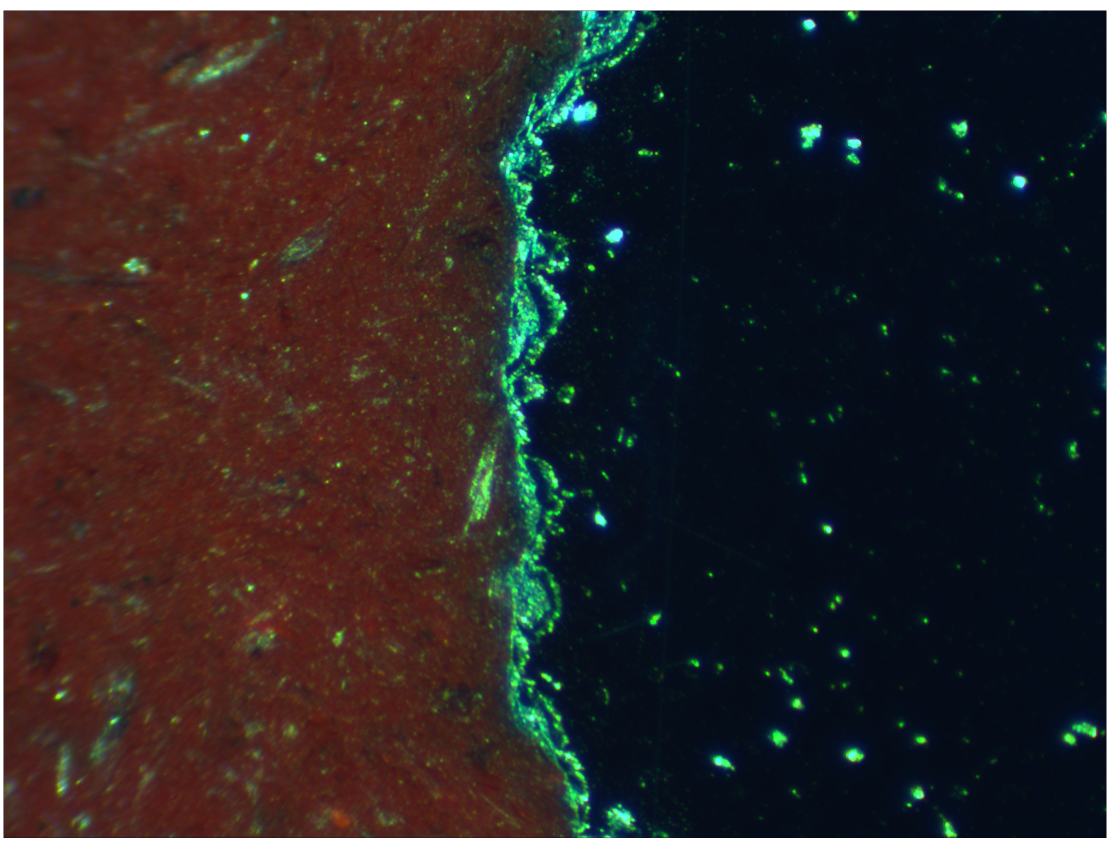

Figure 9
Nicrothal 80, 2300°F, 500 hours, photographed at 45X

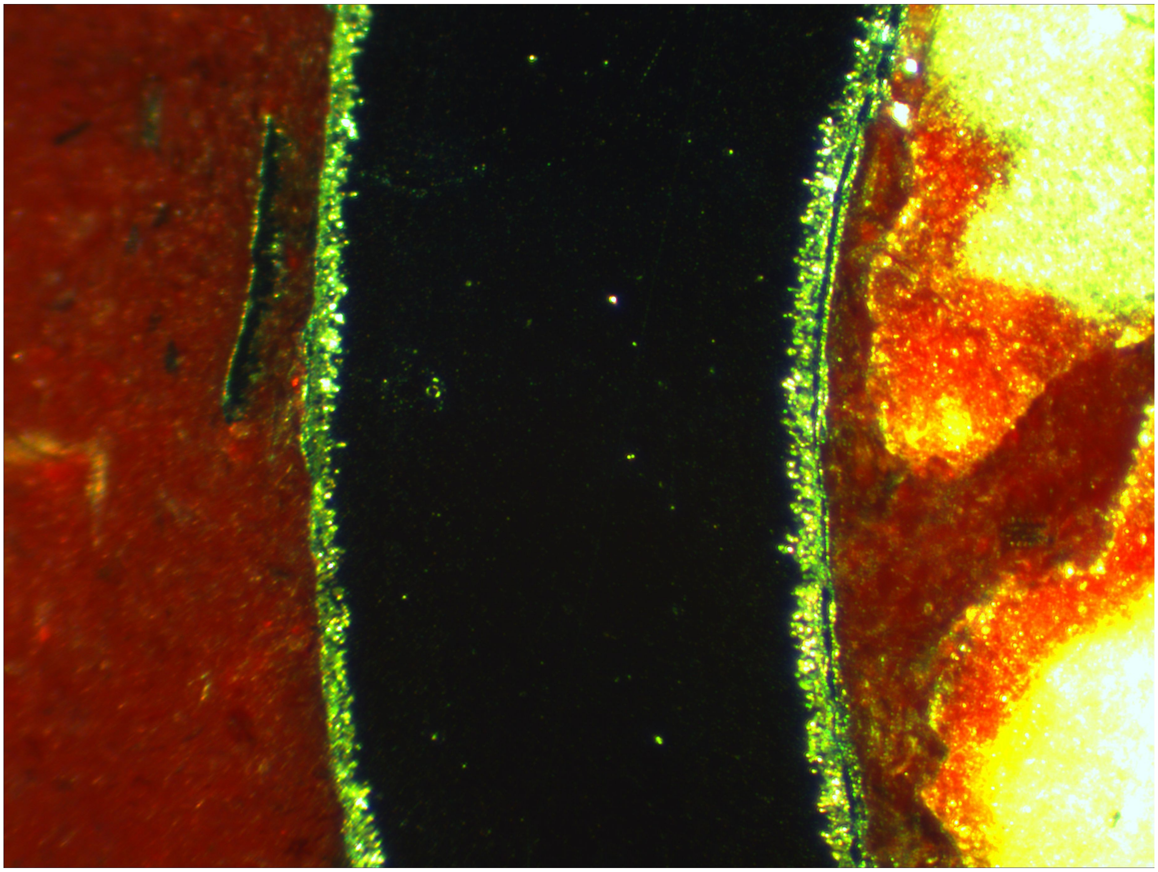

Figure 10
Pyrosil D, 2300°F, 500 hours, photographed at 45X