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EVALUATION OF HASTELLOY X AS A
NUCLEAR CLADDING

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1.0 PROGRAM STATUS

1.1 TECHNICAL STATUS

Preparation of a final report of activities under the structural stability and oxidation tasks of this program continued.

The 3000 hour, 1400°F centrifugal creep testing of Hastelloy X specimens continued.

The 3000 hour, 1300°F tensile creep testing of Hastelloy X specimens continued.

The preparation of two papers for presentation at the NACE Research Conference, 18-21 March 1968, Cleveland, Ohio, was initiated.

The status of the various tasks in the program is shown in Figure 1.

2.0 TECHNICAL STATUS

2.1 OXIDATION STATUS

Preparation of a final report for Tasks A-1, 2 and 3 continued.

Preparation of two papers for presentation at the NACE Research Conference was completed. The papers will be presented 18-20 March 1968 in Cleveland, Ohio.

2.2 MECHANICAL PROPERTIES EVALUATION

2.2.3.1 Metallographic Studies of Centrifugal Creep Specimens

Hastelloy X specimens, which were heat-treated in the unstressed condition to simulate the thermal history of a centrifugal creep specimen during start-

FIGURE 1. HASTELLOY X EVALUATION PROGRAM MILESTONE CHART

MILESTONE, SCHEDULED (OPEN) AND COMPLETE (SOLID)

ORIGINAL MILESTONE RESCHEDULED AS SHOWN

TASK CONTINUES BEYOND END OF SCHEDULE PERIOD

up of a 1300°F centrifugal creep test, were electrolytically digested for phase analysis. The residues were analyzed by X-ray diffraction and found to contain only the M_6C -type carbide precipitate characteristic of Hastelloy X. No mu or sigma phase precipitates were noted, indicating that the sigma phase detected in the 1300°F (inert gas) creep specimens was not precipitated during the heat-treat cycle. This does not eliminate the possibility, however, that the heat treatment cycle causes a metastable condition which results in increased susceptibility of the alloy matrix to accelerate sigma formation during testing at 1300°F. In the absence of more extensive aging studies, this effect can only be assessed by the evaluation of available centrifugal and tensile creep specimens as the test program progresses.

2.2.3.2 Tensile Creep Tests at 1300°F in Argon Atmosphere

The tensile creep testing of two specimens of Hastelloy X Heat X 4793 in argon at stress levels corresponding to the highest and lowest centrifugal creep stress levels continued. This test had accumulated about 1900 hours at the end of February.

2.2.4 Task B-5, 1400°F in Argon Atmosphere

Centrifugal creep tests of five specimens of each of the three heats of Hastelloy X (X9505, 4793 and 4904 (vacuum melted)) in high purity argon had accumulated about 2200 hours at the end of February.

3.0 WORK PLANNED FOR MARCH

3.1 TASK A OXIDATION STUDIES

Preparation of the final report will continue. Two papers will be presented at the NACE meeting.

3.2 TASK B - MECHANICAL PROPERTIES EVALUATION

3.2.1 Task B-4 1300°F Tests in Argon Atmosphere

3.2.1.1 Tensile Creep Tests

The tensile creep tests in argon at 1300°F will continue.

3.2.1.2 Metallographic Examination

Tensile creep specimens tested at 1300°F will be examined to determine the magnitude of precipitates formed for comparison with precipitates found

in centrifugal creep-tested and unstressed specimens.

3.2.2 Task B-5, 1400°F Test in Argon Atmosphere

3.2.2.1 Centrifugal Creep Tests

The centrifugal creep testing of specimens of three heats of Hastelloy X will continue.