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RADIOMETALLURGY EXAMINATION OF THREE OVERBORE SPLIT FAILURES FROM 3062C (RM C-422)

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RADIOMETALLURGY EXAMINATION OF THREE OVERBORE
SPLIT FAILURES FROM 3062C (RM C-422)

This document consists of
7 pages, No. 14 of
14 copies

R. Teats
October 22, 1963

Introduction

Three overbore elements, 75Z12, 75Z14, and 75Z15 were discharged from 3062C on April 16, 1962 with longitudinal splits after an exposure of 676. The three elements, two of which had completely split apart, were received on July 5, 1963 to determine the cause of failure.

Summary and Conclusions

All three elements had failed in the same manner with several full length longitudinal cracks in the uranium extending radially from the canwall to about midway in the core. The failure mechanism was found to be the same as that observed during the examination of worm-tracked overbore elements under RM 456 in which incipient failures had occurred from excessive core temperatures (1). In two out of the three worm-tracked elements the interior core temperatures had exceeded the beta transformation point as a result of severe cycling conditions. In these three ruptures from 3062C the maximum core temperature had not reached the beta phase; however, the failures were undoubtedly caused by excessive hoop stresses resulting from high internal core temperatures.

Details

All three elements were sectioned transversely near the center, and it was found that the fracture pattern was almost identical on each element. Radial cracking had occurred from the periphery to a point about midway in the core. From there the cracks had branched out into a "Y" and progressed in a general tangential

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direction until they intersected the cladding or another radial crack. The same "Y" shaped cracks were found in the worm-tracked overbore elements examined under RM 456, but in that case the cracking had not yet progressed far enough to cause failure of the cladding.

The transverse sections were etched as shown in Figs. 4 and 5, and there was no indication that the internal core temperatures had reached the beta phase.

R. Teats

R. Teats, Engineer
Radiometallurgy Laboratory

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Fig. 1 As received side views of element Z12. The missing section of core is not shown.

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Fig. 2 As received side views of element Z14. The two missing sections of the core and the male end cap are not shown.

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Fig. 3 As received side views of element Z15.

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Fig. 4 Cathodically etched sections from elements Z12 at top and Z14 below.

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Fig. 5 Cathodically etched section from element Z15.

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