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Report
on

SINGLE RUPTURE TESTS ON FIVE BETHLEHEM STEELS AT 1000°F.

by

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for

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SINGLE RUPTURE TESTS ON FIVE BETHLEHEM STEELS AT 1000°F.

Five specimens were submitted by the Bethlehem Steel Company under date of January 15, 1942 for the determination of rupture test characteristics at 1000°F. under a stress of 42,000 pounds. These tests were for the purpose of determining the effect of variations in heat treatment on materials similar to those described in Report Number 1.

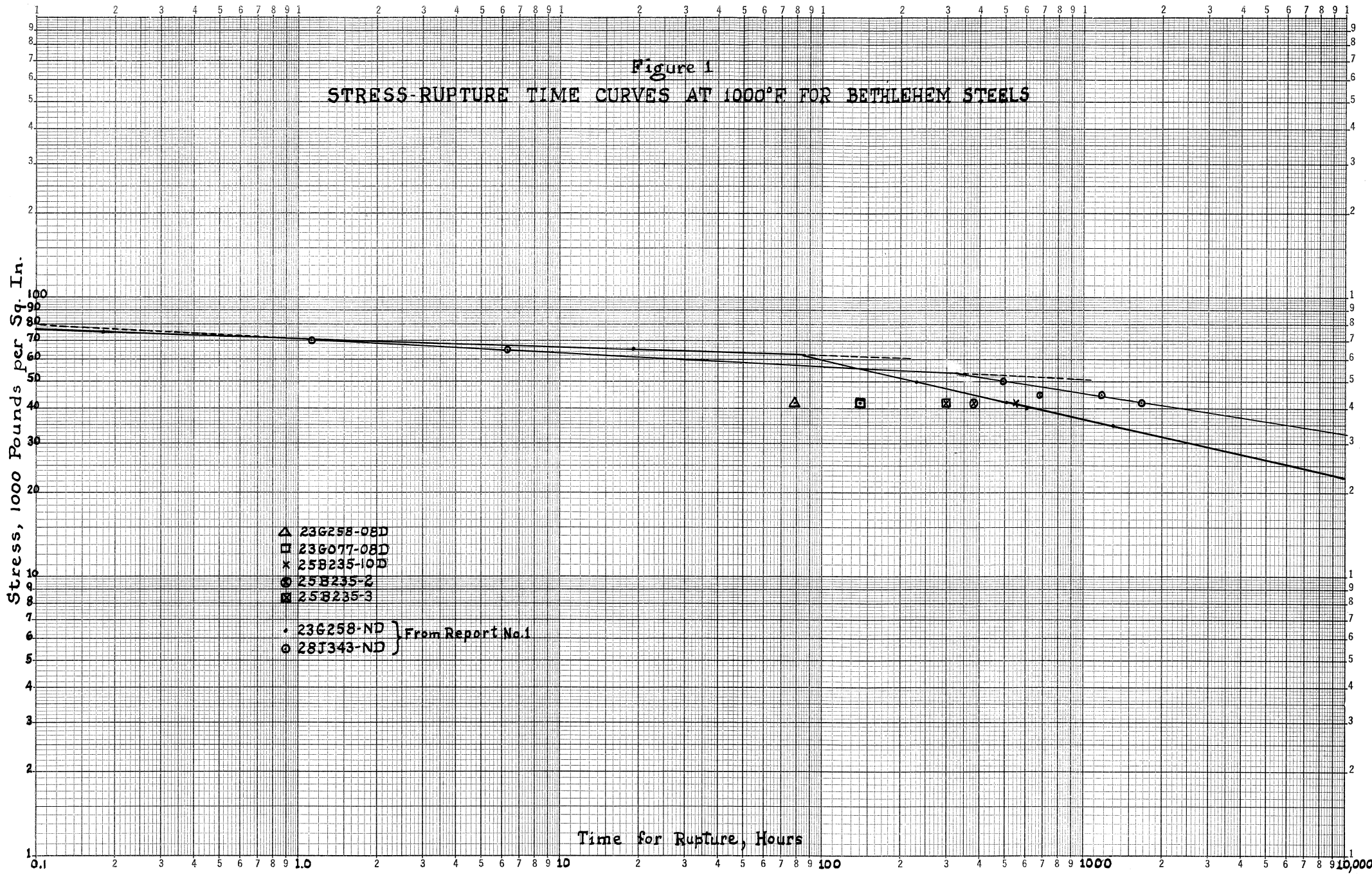
Rupture Test Characteristics

The five specimens were tested at 1000°F. under a stress of 42,000 pounds. All tests were conducted on 0.505 inch diameter specimens. The rupture test data obtained are given in the following tabulation.

| <u>Specimen Designation</u> | <u>Rupture Time Hours</u> | <u>Elongation % in 2 In.</u> | <u>Reduction of Area %</u> |
|---------------------------------|-------------------------------|----------------------------------|--------------------------------|
| 23G258-08D | 79.0 | 29.0 | 57.0 |
| 23G077-08D | 139.5 | 29.0 | 53.6 |
| 25B235-10D | 552.0 | 14.0 | 21.6 |
| 25B235-2 | 381.0 | 9.0 | 12.6 |
| 25B235-3 | 299.0 | 11.0 | 15.2 |

The stresses and corresponding rupture time periods have been plotted to logarithmic coordinates in Figure 1. For comparative purposes the curves from Report Number 1 have been included.

Figure 1
STRESS-RUPTURE TIME CURVES AT 1000°F FOR BETHLEHEM STEELS



- △ 23G258-08D
- 23G077-08D
- × 25B235-10D
- 25B235-2
- 25B235-3
- 23G258-ND } From Report No.1
- 28J343-ND }

On the basis of comparative times for rupture at 1000°F. under a stress of 42,000 pounds, material 25B235-10D possessed the best load carrying ability of the five materials considered. Likewise it was about equal to the 23G258-ND material of Report Number 1. The other four materials were all weaker with the rupture time periods varying from 79 hours for 23G258-08D to the 552 hours for 25B235-10D.

Two materials, 23G258-08D and 23G077-08D, exhibited very good ductility characteristics. The other three materials were relatively brittle.

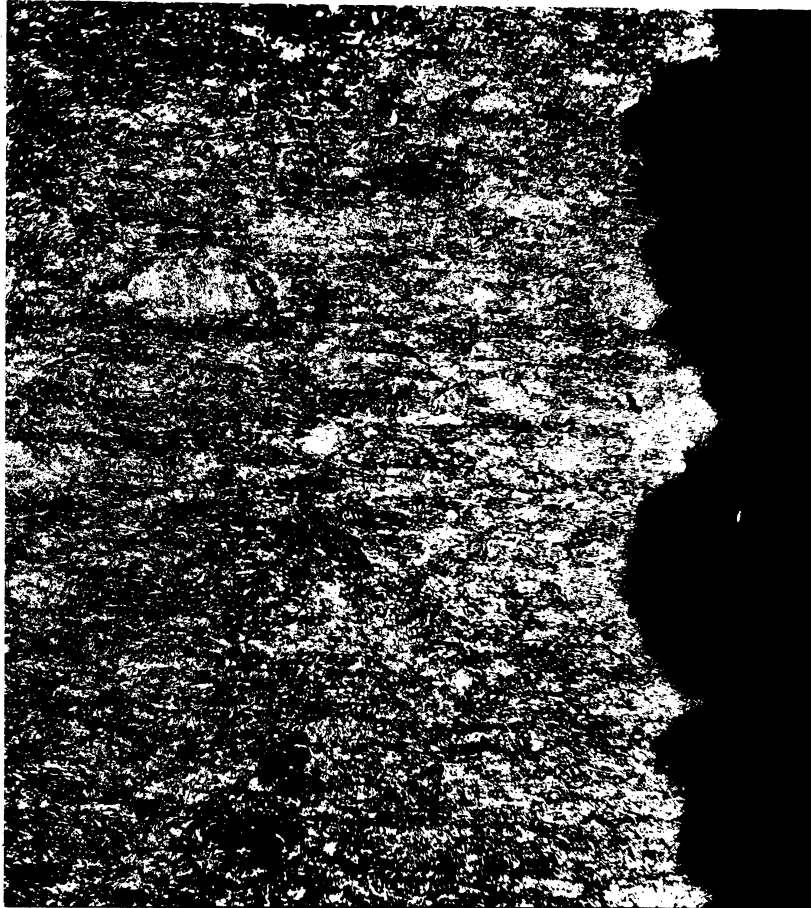
Metallographic Examination

The longitudinal sections at the fracture of the completed rupture test specimens were examined metallographically. The photomicrographs of Charts 1 through 5 were taken at the fracture and at the surface of the specimen about one-half inch from the fracture. The photomicrograph at the fracture illustrates the type of failure and the surface position shows the amount of cracking adjacent to the point of failure.

Charts 1 and 2 show that, in accordance with the ductility values, materials 23G258-08D and 23G077-08D failed with considerable distortion and very little cracking. Numerous fine intergranular cracks, which were filled with oxide near the surface, were present in specimens 25B235-10D and 25B235-2.

There were not as many fine cracks present in the 25B235-3 sample but the presence of larger cracks suggests that the material is more subject to crack propagation once one starts than the others.

Chart 1
Microstructure of Bethlehem 23G258-08D Steel Rupture Test Specimen
79 Hours for Rupture at 1000°F. Under a Stress of 42,000 Pounds



Fracture - X100D

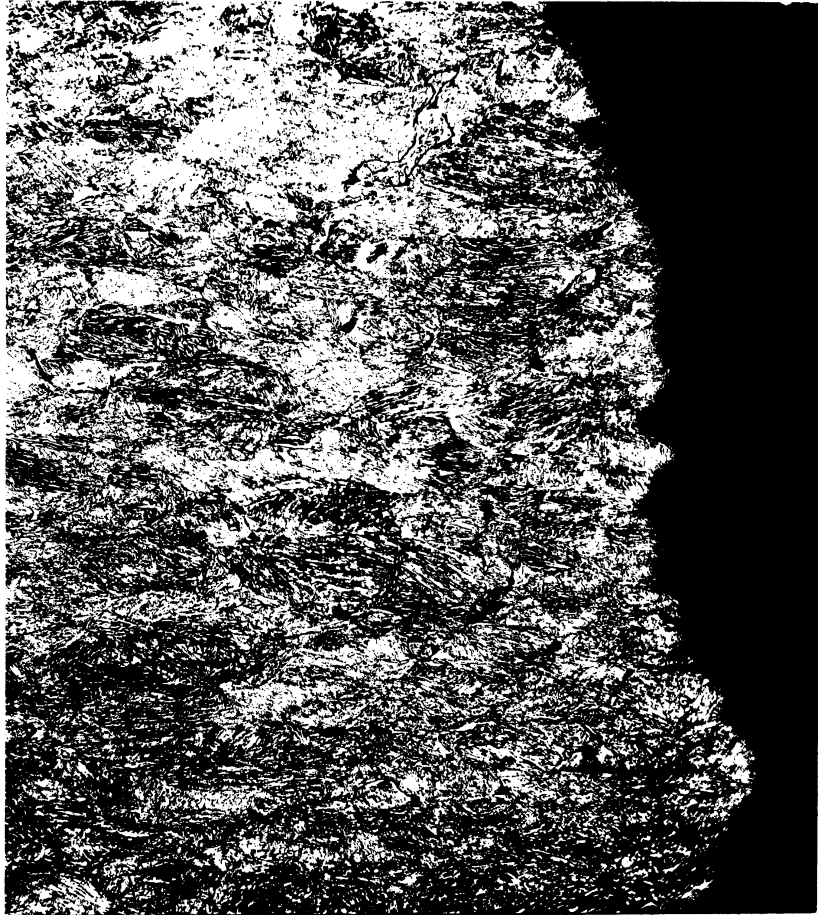
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Surface - X100D

10951

Chart 2
Microstructure of Bethlehem 230077-08D Steel Rupture Test Specimen
139.5 Hours for Rupture at 1000°F. Under a Stress of 42,000 Pounds



Fracture - X100D

10952



Surface - X100D

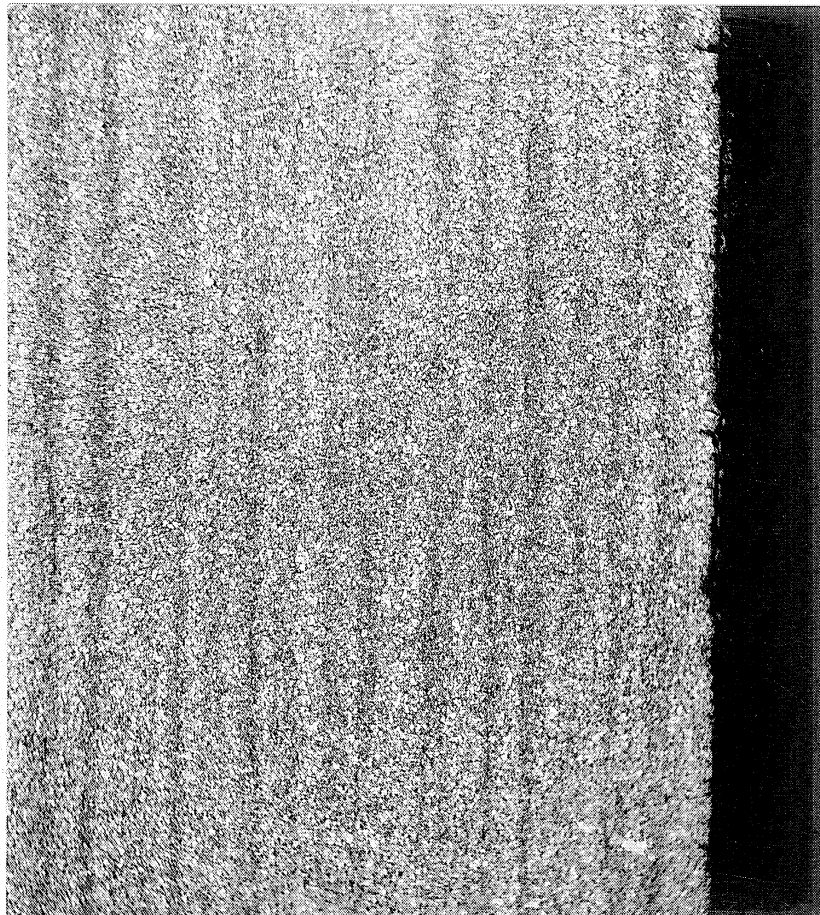
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Chart 3
Microstructure of Bethlehem 25B235-10D Steel Rupture Test Specimen
552 Hours for Rupture at 1000°F. Under a Stress of 42,000 Pounds



Fracture - X100D

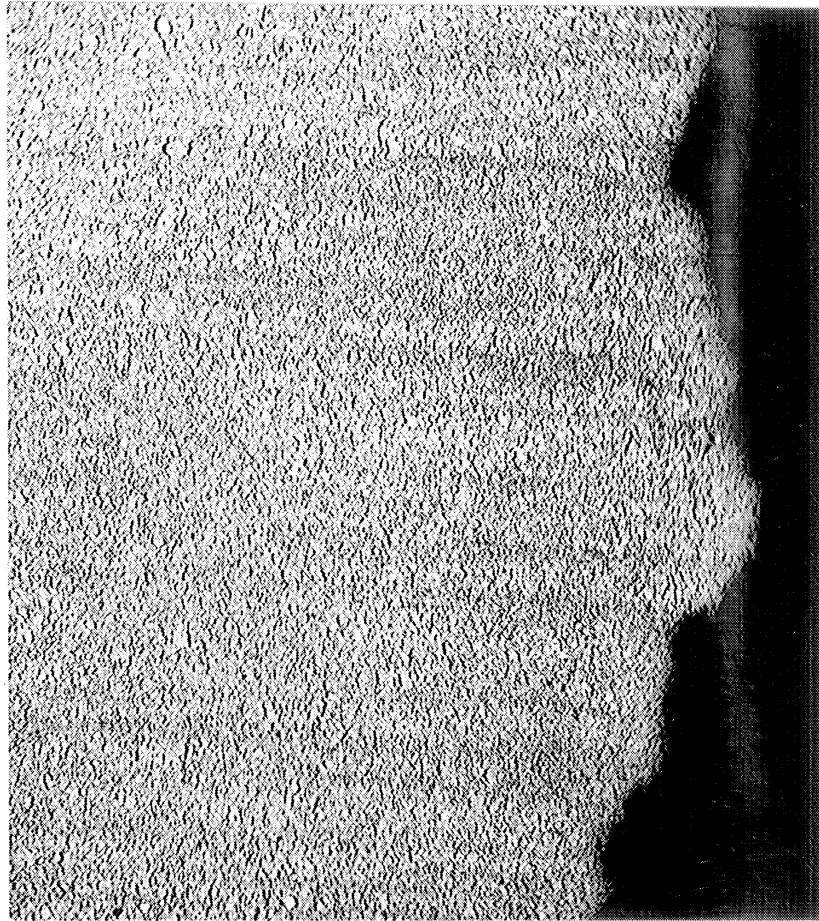
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Surface - X100D

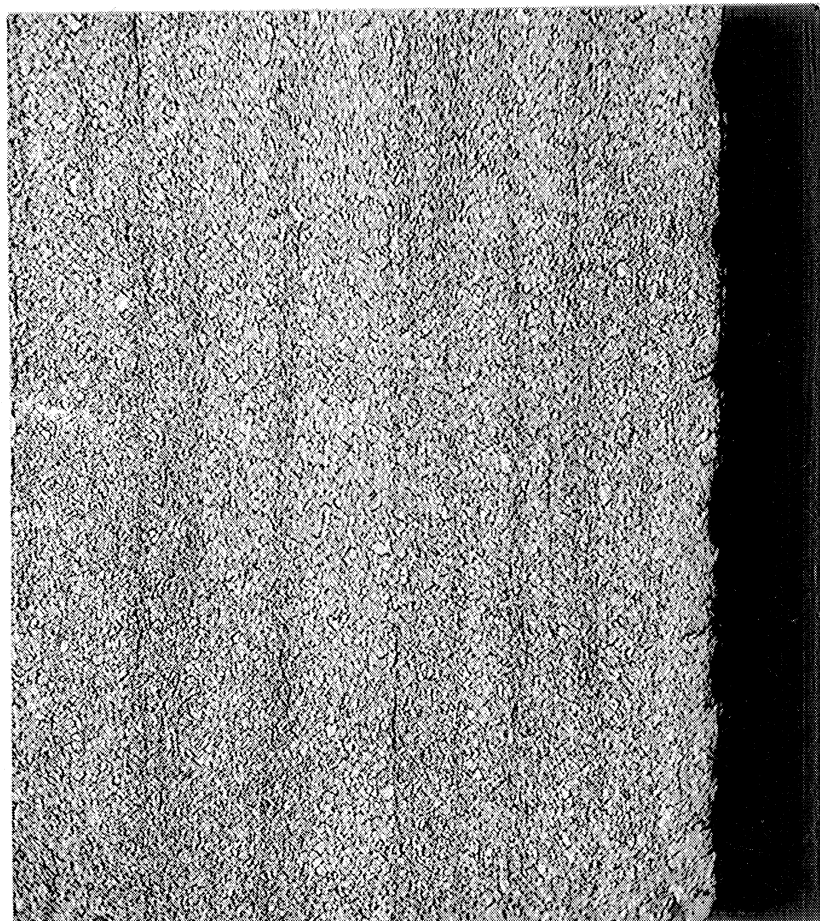
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Chart 4
Microstructure of Bethlehem 25B235-2 Steel Rupture Test Specimen
381 Hours for Rupture at 1000°F. Under a Stress of 42,000 Pounds



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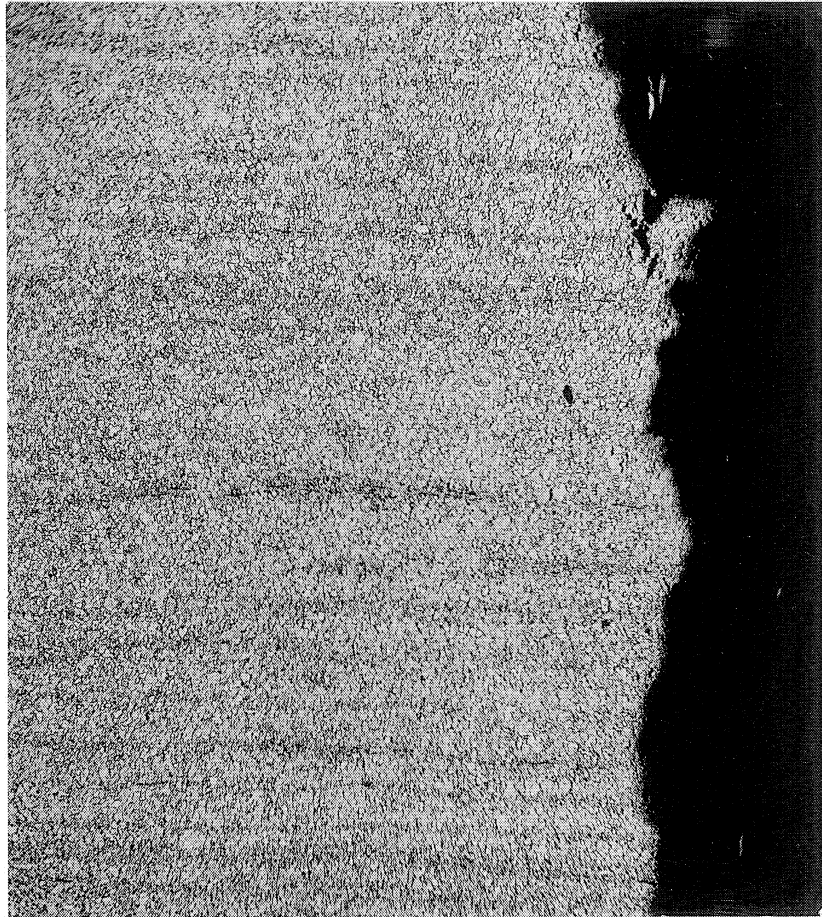
Fracture - X100D



10957

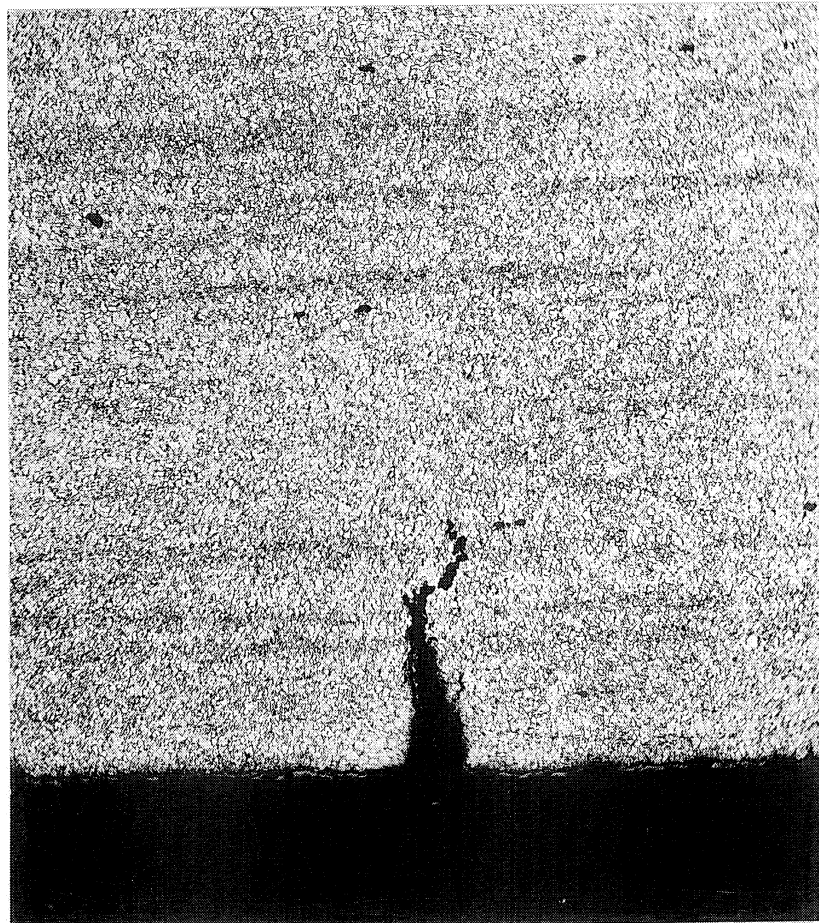
Surface - X100D

Chart 5
Microstructure of Bethlehem 25B235-3 Steel Rupture Test Specimen
299 Hours for Rupture at 1000°F. Under a Stress of 42,000 Pounds



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Fracture - X100D



10959

Surface - X100D

