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Development and Manufacture of Low PCM, High Toughness Steel Plates for API 5L-X60 UO Pipe

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Synopsis :

A steel was developed and applied to the production of plates for UOE line pipes which are used to transport sour oil in the North Sea. The steel plates 22.2 to 38.1 mm thick were made of API 5L-X60 and weigh 50 000 tons in total. The most critical and the most difficult requirements to be met follow: The PCM which is an indicator of the susceptibility to weld cracking should be as low as 0.150% for plates 22.2 and 23.8 mm thick. These requirements were unable to be satisfied by the ordinary manufacturing process. Only the thermomechanical control process (TMCP) and the fine steel making process were able to do it. The present paper describes the details of the steel plate manufacturing processes and the properties obtained.

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The body can be viewed from the next page.

Development and Manufacture of Low P_{CM} , High Toughness Steel Plates for API 5L-X60 UO Pipe*



Synopsis:

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P 10 of the offshore line pipe was limited to 0.150 or less position design in this case embodied the following

from considerations of weldability because it was to be laid from laying barges at sea. Limitations in chemical composition were somewhat relaxed for the 38.1-mm

concepts:

- (1) To realize welding without preheating and postweld heating and to obtain excellent HIC resistance and

2.3 Controlled Rolling and Accelerated Cooling

To obtain the required performance in such a low C-low Mn-Cu-Ni-Nb-V-Ti-(Mo) steel as described above, it is necessary to optimize reheating, rolling, and cooling conditions. The effects of controlled rolling and accelerated cooling

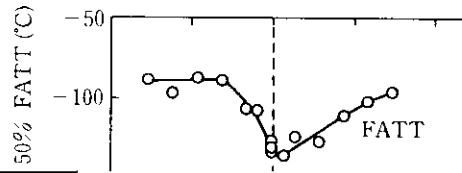


Table 2 Chemical composition (Aiming) (wt%)

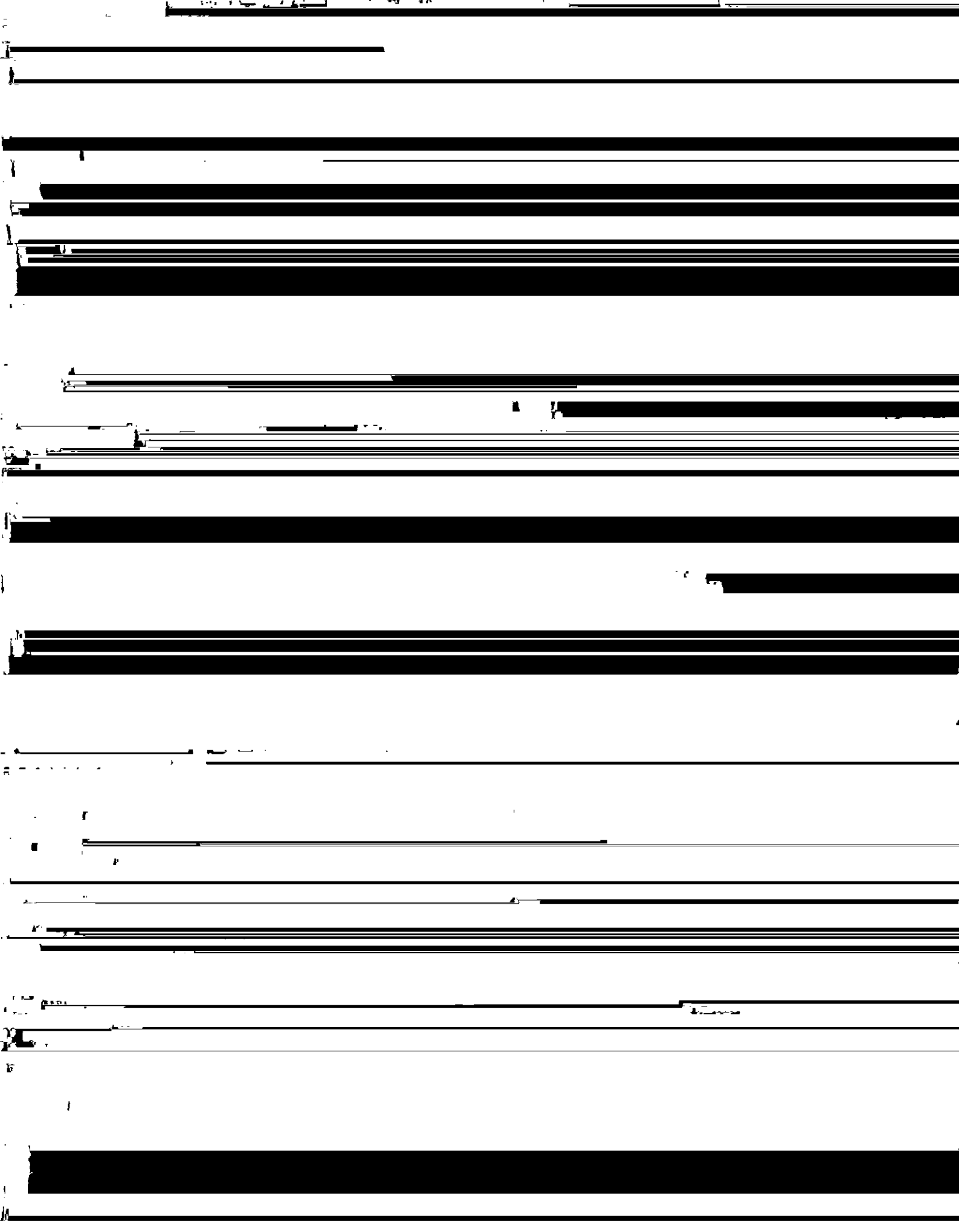
| Thickness | C | Si | Mn | P | S | Others | P_{CM} |
|-----------|------|------|------|--------------|------------------|----------------------|----------|
| 22.2 mm, | 0.06 | 0.25 | 1.17 | ≤ 0.008 | ≤ 15 ppm | V, Nb, Ti, Al, Cu | 0.147 |

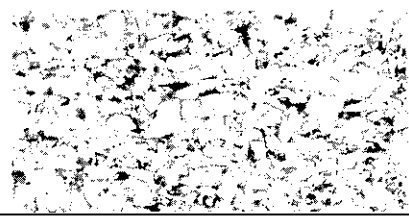
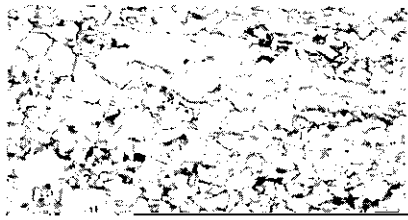
peratures. This tendency seems to be especially marked with low-C, low-Mn steels such as the present one, where the frequency of nucleation of ferrite in the period between the end of rolling and the start of cooling and the rate of ferrite growth are both high. On the other

configuration of the system for controlling mechanical

5f

5f





range) 100 0°C

strating the homogeneity of the mechanical properties of each plate. Moreover, no cracks whatsoever were