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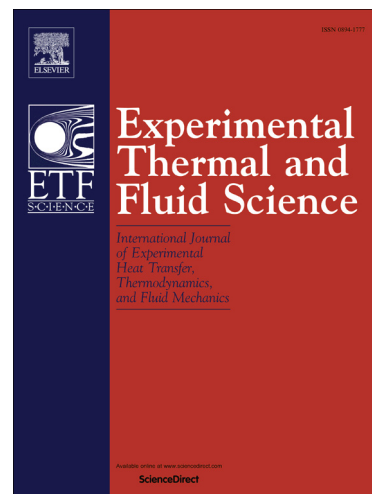
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Flow structure and pressure gradient of extra heavy crude oil-water two-phase flow

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Abstract

The flow structure and pressure gradient of extra heavy crude oil (viscosity=11232.8mPa·s at 50°C) and water two-phase flow were studied in a horizontal flow loop with 25.8mm inner diameter and overall length of 30.8m. With the help of high-speed photography, local sampling and pressure gradient testing, six different flow patterns were identified. A new flow pattern—discrete water-in-oil emulsion and water annular flow (Ew/o&w dispersion-annular flow)—was found at high water fractions and high mixture velocities. The size distribution of water droplets in Ew/o flow and the periodic characteristics of Ew/o&w intermittent flow were analyzed in detail. Relative pressure gradient was introduced to characterize the oil-water two-phase flow. The pressure gradients of water dominated flow are two orders of magnitude lower than that of oil dominated flow. The water fraction and temperature have little effect on the pressure gradient of water dominated flow, particularly in annular flow. The water dominated flow should be given priority to when it comes to the transportation of extra heavy crude oil and water. The results establish a

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