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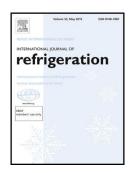
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Visualization and quantification of separation of liquid-vapor twophase flow in a vertical header at low inlet quality

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Highlights

- This paper presents visualization of vapor-liquid separation in a vertical header.
- Excellent separation occurs at low inlet mass flux of the header (D=15.8 mm).
- Recipe for separation is to allow upward vapor and downward liquid pass each other.
- Liquid reach is higher with higher vapor upward velocity or higher liquid load.
- When liquid reach touches the top end, separation becomes the most ineffective.

Abstract

This paper presents the experimental study of separation of two-phase flow in a vertical header of microchannel heat exchanger based on quantified visualization using fast camera. A prototype unit, representing the real condenser has an inlet in the center of the header. Downstream of the intermediate header are two branches: lower for liquid and upper vapor flow. The header for experiment provides full visual access. R-134a is used as the fluid and mass flux through the inlet microchannels is controlled at 54 kg m⁻² s⁻¹ – 193 kg m⁻² s⁻¹. The results indicate that within the range of lower inlet quality (5-25%), good separation in that header can happen at low mass flux up to 90 kg m⁻² s⁻¹. Results are presented in function of liquid and vapor separation efficiencies (η_1 , η_v). Two-phase flow characteristics inside the header are analyzed for better understanding of separation efficiencies η_1 and η_v . The efficiency deteriorates dramatically when liquid reaches the vapor exit, with increasing inlet flow rate and/or quality. Better two-phase separation can be achieved by reducing the liquid upward momentum or the vapor, and decreasing liquid and vapor interaction.

Key words: Two-phase flow; Separation; Microchannel condenser; Visualization; Intermediate header

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