Establishing Research Priorities on Pressure Drops During Flow Boiling of Fluorinated Refrigerants from Literature Survey and Statistical Approach

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The need for improved design of evaporators has led to a significant amount of work during the last three decades in the scientific community. This was mainly due to environmental concerns and the resulting introduction of new refrigerants on the market, higher equipment efficiency requirements, increasing needs for compactness and the associated utilization of new heat transfer materials and enhanced surfaces. The simultaneous introduction of all these manufacturing techniques, materials and chemical substances, in a relatively short time, required the development of prediction techniques, particularly for refrigerant pressure drop during flow boiling. Yet, and due to the variety of situations, flow boiling pressure drop correlations still yield significant discrepancies when confronted to reality, typically of the order of 30 %. A thorough literature survey has been conducted on reported investigations of pressure drop during flow boiling of synthetic refrigerants inside channels. The review covered 88 articles published in 16 journals since 1980 and dealing with 8 different geometries (single tube, enhanced single tube, multiple tubes, single rectangular channel, multiple rectangular channels, multiple enhanced rectangular channels, singularities). A total of 21 oil-free pure CFC, HCFC and HFC refrigerant fluids were studied. By analyzing the literature data using a statistical approach, and based on the important geometry and flow parameters (diameter, aspect ratio, Bond Number, mass velocity, etc), this paper synthesises the results of the investigations conducted so far in a new, original manner. Different research priorities are highlighted, which would significantly enhance the quality of a worldwide database on pressure drop during flow boiling and increase the reliability of the existing prediction methods. This would also give the tremendous advantage of generalizing the correlations or models to a variety of other fluids.