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The pool boiling heat transfer of ammonia/Fe_3O_4 nano-refrigerant in the presence of external magnetic field and heat flux: A molecular dynamics approach

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Abstract

Pool boiling is distinguished by its capacity to eliminate excessive heat fluxes (HFs) at low temperatures. In recent decades, the optimal design of flooded evaporators elevated the significance of pool boiling HT with refrigerant to conserve natural resources and energy. The industry highly regards this process on account of its superior heat transfer (HT) coefficient in comparison to other HT mechanisms. Among the types of boiling, pool boiling has a special place due to its ability to remove HFs at low temperatures. This study was the first to investigate the boiling characteristics of the ammonia/Fe_3O_4 nano-refrigerant in a copper (Cu) nanochannel (NC) through molecular dynamics (MD) simulations. The primary goal was to investigate the effect of external HF (EHF) and external magnetic field amplitude (EMFA) on nanostructures' atomic behavior (AB) and thermal behavior (TB). The research findings indicate that increasing the applied EHF led to increased particle movement and the HT rate. By changing the EHF, boiling behavior in the nano-refrigerant may also be seen. Maximum (Max) velocity (Vel.) increased to 8.970 Å/ps when the EHF increases to 0.5 W/m^2. Atomic collisions and particle mobility both increase when the EHF increases. Therefore, the maximum temperature value increases to 359.46 K. When the EMFA applied to the nano-refrigerant reaches to 0.5 T, the maximum values of the parameters, such as the Temp. and the velocity, reach to 410.07 K, and 11.802 Å/ps, respectively.