











# The effect of external force and magnetic field on atomic behavior and pool boiling heat transfer of $\text{Fe}_3\text{O}_4$ /ammonia nanofluid: A molecular dynamics simulation

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## Abstract

### Background

In this study, the pool boiling heat transfer of  $\text{Fe}_3\text{O}_4$  / ammonia nanofluid in a copper (Cu) nanochannel is done using the molecular dynamics (MD) simulation.

### Methods

To increase and improve the performance of heat transfer, the effect of external force, and external magnetic field frequency on the atomic and thermal performance of the simulated nanostructure was checked. The results show that the density increased with a positive slope when the external force was imposed on the nanostructure with a growing trend. The amount of velocity and temperature similarly increased. So, by increasing the external force from 0.001 to 0.005 eV/Å, the maximum values of density, velocity, and temperature converge to the values of 0.1441 atom/Å<sup>3</sup>, 13.939 Å/fs, and 794.61 K. Moreover, increasing the applied external force caused an increase in the heat flux and thermal conductivity in the nanostructure. Finally, studying the effect of external magnetic field on the nanofluid's atomic behavior shows that with the change in the frequency of external magnetic field, Poiseuille behavior was remained. The results of the increase in the frequency of external magnetic field show the increasing trend of velocity and temperature. Numerically, the maximum values of velocity and temperature increase from 7.133 to 11.476 Å/fs, and from 210.23 to 410.07 K, respectively. Furthermore, HF increases by increasing the frequency of external magnetic field.

### Significant findings

As particles' movement increased, the structure's thermal resistance decreased. So, by increasing external force, the thermal resistance in the structure decreased.