NUMERICAL SIMULATION OF MOISTURE CONDENSATION ON WATER DROPLETS IN AIR FLOW

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Abstract

This paper presents a two dimensional numerical study of drying of the humid air due to injection of water droplets contrary to the mixture flow direction. Direct contact condensation is the main phenomenon that takes place due to interaction of sub-cooled water droplet and hot moist air. The goal of the investigation is to analyze the temperature and relative humidity distribution at different locations of the channel. The droplet evaporation and condensation are analyzed using ANSYS-FLUENT commercial software. Diameter of water droplets are between 10 μm and 80 μm and mass flow rates of the spray are in the range of 3 g/s and 6 g/s. The analysis predicts that droplet transport and evaporation depend on many parameters such as channel geometry, main stream velocity and temperature, and the injection initial properties. The article investigates the effect of injection water droplet diameter and the mass flow rate. Both radial and axial temperature and relative humidity are discussed. Smaller droplets lead to higher reduction of relative humidity at the outlet compared to larger droplets. Smaller droplets lead to higher condensation rate, particularly at the central core of the chamber. It is also shown that the heat transfer enhances when mass flow rate of the water spray is increased. Accordingly relative humidity decreases and temperature increases at the outlet. Axial and radial temperature and relative humidity profiles are discussed for different cases.

Keywords: direct contact condensation, droplet, dehumidification