THERMAL SCIENCE
International Scientific Journal

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TWO-DIMENSIONAL MODELING OF WATER SPRAY COOLING IN SUPERHEATED STEAM

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ABSTRACT

Spray cooling of the superheated steam occurs with the interaction of many complex physical processes, such as initial droplet formation, collision, coalescence, secondary break up, evaporation, turbulence generation, and modulation, as well as turbulent mixing, heat, mass and momentum transfer in a highly non-uniform two-phase environment. While it is extremely difficult to systematically study particular effects in this complex interaction in a well defined physical experiment, the interaction is well suited for numerical studies based on advanced detailed models of all the processes involved. This paper presents results of such a numerical experiment. Cooling of the superheated steam can be applied in order to decrease the temperature of superheated steam in power plants. By spraying the cooling water into the superheated steam, the temperature of the superheated steam can be controlled. In this work, water spray cooling was modeled to investigate the influences of the droplet size, injected velocity, the pressure and velocity of the superheated steam on the evaporation of the cooling water. The results show that by increasing the diameter of the droplets, the pressure and velocity of the superheated steam, the amount of evaporation of cooling water increases.

KEYWORDS

cooling water, spray formation, break up model, evaporation, two-phase flow, turbulence

PAPER SUBMITTED: 2007-01-17

PAPER REVISED: 2007-12-02

PAPER ACCEPTED: 2007-12-07

DOI REFERENCE: TSCI0802079E

CITATION EXPORT: view in browser or download as text file

THERMAL SCIENCE YEAR 2008, VOLUME 12, ISSUE 2, PAGES [79 - 88]

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