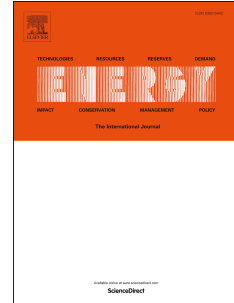


Accepted Manuscript

A novel CFD approach for the computation of R744 flashing nozzles in compressible and metastable conditions

Francesco Giacomelli, Federico Mazzelli, Adriano Milazzo



PII: S0360-5442(18)31570-6

DOI: [10.1016/j.energy.2018.08.050](https://doi.org/10.1016/j.energy.2018.08.050)

Reference: EGY 13526

To appear in: *Energy*

Received Date: 30 April 2018

Revised Date: 3 August 2018

Accepted Date: 6 August 2018

Please cite this article as: Giacomelli F, Mazzelli F, Milazzo A, A novel CFD approach for the computation of R744 flashing nozzles in compressible and metastable conditions, *Energy* (2018), doi: 10.1016/j.energy.2018.08.050.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

A novel CFD approach for the computation of R744 flashing nozzles in compressible and metastable conditions

Francesco Giacomelli*, Federico Mazzelli*, Adriano Milazzo*

*Department of Industrial Engineering (DIEF), University of Florence, 50139 Florence, Italy
francesco.giacomelli@unifi.it

ABSTRACT

The present paper describes a novel CFD approach for the flashing of CO₂ through nozzles and ejectors. The novelty of the method is represented by the possibility of defining both the liquid and vapor phases as compressible materials. The properties of each phase are obtained via look-up tables calibrated against standard fluid libraries and are valid in the whole domain of interest, including the supercritical, subcritical and metastable regions.

The model has been implemented within a commercial CFD solver and is completely general, i.e., it can be applied to any type of compressible multiphase flow. In the present study, the proposed approach has been validated against an experimental test-case available in literature.

Keywords: R744, flashing Nozzle, CFD, look-up tables, metastable properties

Nomenclature		Greek letters	
a	Speed of sound (m s ⁻¹)	α	Volume fraction
E	Energy	β	Mass fraction of the phase
f, g	Functions in Eq. 9	Γ	Source term
h	Enthalpy (kJ kg ⁻¹)	ε	Rate of turbulence dissipation
k	Turbulence kinetic energy	θ	Angle of diverging nozzle (°)
p	Pressure (Pa)	ρ	Density (kg m ⁻³)
q	Conductive heat transfer	ζ	Mass-specific thermodynamic property
T	Temperature (K)	τ	Shear stress (Pa)
t	Time (s)	χ	Volume-specific thermodynamic property
x	Coordinate (m)		
Y	Mass fraction of the species		
Superscripts/subscripts		Acronyms	
c	Condensation	CFD	Computational Fluid Dynamics
e	Evaporation	EOS	Equation Of State
eff	Effective	EXP	Experimental
l	Liquid	HEM	Homogeneous Equilibrium Model
m	Mixture	HFO	Hydro-Fluoro-Olefin
sat	Saturation	SST	Shear Stress Transport
v	Vapor	UDF	User Defined Function
		UDRGM	User Defined Real Gas Model

1. INTRODUCTION

The use of ejectors to improve the efficiency and capacity of vapor compression chillers has seen a renewed interest from both industry and academy in recent years. One of the fluids that benefits the most from the

Download English Version:

<https://daneshyari.com/en/article/11007387>

Download Persian Version:

<https://daneshyari.com/article/11007387>

[Daneshyari.com](https://daneshyari.com)