

Cambridge University Press

978-0-521-48192-2 - Cryogenic Two-Phase Flow: Applications to Large-Scale Systems

N. N. Filina and J. G. Weisend II

Table of Contents

[More information](#)

## Contents

<i>Preface</i>	<i>page</i> vii
<i>Nomenclature, SI units</i>	ix
1 Introduction to cryogenic systems with two-phase flows	1
1.1 Cryogenic gasification systems	1
1.1.1 Cryogenic liquid gasifiers (vaporizers)	6
1.1.2 Liquefied natural gas (LNG) systems	7
1.2 Cryostabilization systems	10
1.2.1 Space-simulation chambers	10
1.2.2 Superconducting magnet systems	10
1.3 Cryogenic fluid transport systems	14
1.4 Two-phase (vapor–liquid) flows	15
1.4.1 Two-phase flow regimes	16
1.4.2 Models of two-phase flows	18
1.5 Requirements for the design of practical systems with two-phase flows	19
2 Hydrodynamics and heat transfer in two-phase flows in cryogenic media	20
2.1 Physical features of cryogenic vapor–liquid flows	20
2.1.1 Equilibrium and nonequilibrium two-phase flows	22
2.2 Conservation equations for heterogeneous two-phase flows	23
2.3 Gasifier channels with intensifiers	25
2.3.1 Mathematical description	29
2.4 Two-phase helium in magnet-stabilization channels	37
2.4.1 Experimental studies	39
2.4.2 Mathematical modeling	44

Cambridge University Press

978-0-521-48192-2 - Cryogenic Two-Phase Flow: Applications to Large-Scale Systems

N. N. Filina and J. G. Weisend II

Table of Contents

[More information](#)

vi	<i>Contents</i>	
2.5	Transportation of cryogenic fluids with partial evaporation and the geyser effect	56
2.5.1	Fluid transportation in horizontal pipelines	56
2.5.2	The geyser effect	56
2.6	Two-phase flow regimes and optimum heat transfer	68
2.7	Modeling of two-phase flows	69
2.8	Summary	75
3	Transient operating conditions in cryogenic systems with two-phase flow	77
3.1	Introduction to transient conditions	77
3.2	Evaluation methods for external disturbances	78
3.2.1	Changes in mass flowrate	79
3.2.2	Changes in external heat load	80
3.2.3	Changes in system pressure	80
3.3	Summary	81
4	Transient conditions in gasification systems	82
4.1	Results of operating experience	82
4.2	Physical nature of the oscillations	86
4.3	Hydrodynamic model	88
4.3.1	Comparison of model predictions with experimental data	92
4.4	Nondimensional analysis	98
4.5	Analysis of high-speed transients	100
4.6	Practical considerations in the design of gasification systems	105
4.7	Summary	106
5	Transient conditions in magnet-stabilization channels	107
5.1	Modeling of transients resulting from variable heat loads	107
5.2	Results of the analysis	113
5.2.1	Variation in pressure	114
5.2.2	Variation in velocity	114
5.2.3	Variation in void fraction	116
5.2.4	Variation in liquid flowrate	117
5.2.5	Summary of the model results	119
5.3	Experimental studies	121
5.4	Summary	128
	<i>Bibliography</i>	130
	<i>Index</i>	135