

Contents

List of figures	III
List of tables	XIII
Nomenclature	XIV
1 Introduction	1
2 State of the art	3
3 Setup of test rig	6
3.1 Detonation tube.....	8
3.2 Test section	9
3.3 Nozzle.....	9
3.4 Gas supply	10
3.5 Ignition unit	11
3.6 Particle feeder	13
4 Measurement systems	20
4.1 Laser Extinction Method (LE).....	20
4.2 Laser-Doppler-Anemometry (LDA).....	20
4.3 Schlieren visualization.....	22
4.4 Pressure measurement	23
4.5 Temperature measurement	24
4.6 Material and structural analysis	25
4.7 Particle Image Velocimetry (PIV).....	25
5 Gaseous detonations.....	27
5.1 One-dimensional theoretical models	27
5.2 Deflagration-Detonation-Transition (DDT)	36
6 Gas/Particle flows	37
7 Nozzle design and particle acceleration	49
8 Flow phenomena generated by a detonation tube	71
8.1 Flow inside a closed detonation tube.....	71
8.2 Influence of mixing time before ignition.....	72
8.3 Flow inside an half open detonation tube.....	73

8.4	Outflow characteristics of a half open detonation tube	78
9	Characterization of detonation tube flow and free jet flow with attached nozzle.....	91
9.1	Flow phenomena in a detonation tube with attached nozzle	91
9.2	Characterization of free jet flow with attached nozzle (without particles).....	96
9.3	Free jet flow with installed substrate	99
9.4	Schlieren images with wedge	110
10	Influence of a nozzle valve on operation and nozzle flow	113
11	Particle acceleration in an open detonation tube	117
12	Particle acceleration in a high enthalpy nozzle flow	125
12.1	Particle velocity distribution in the free jet flow	125
12.2	Particle velocities in the impact zone	129
13	Deposition results	132
13.1	Coating samples with open tube	132
13.2	Coating samples with use of the nozzle.....	134
14	Discussion of sprayability in the high velocity-temperature range.....	140
15	Conclusions	144
16	Appendix	145
16.1	Carrier gas mass flow rates.....	145
16.2	Derivation of the particle drag coefficient.....	146
16.3	Non-dimensional equations used for the two-phase simulation	147
16.4	Technical specifications of the data acquisition boards	150
16.5	Drawings of test rig (spraying facility).....	151
16.6	Photographs of test rig	160

References