

Contents

1. Introduction	13
2. Materials, preparation, and apparatus	19
2.1. Materials.....	19
2.1.1. Solid spherical particles	19
2.1.2. Polymer filaments	19
2.2. Preparation methods	20
2.2.1. Electrospun core-shell nanofiber preparation	20
2.2.2. Preparation of microfluidic devices	23
2.3. Apparatus	24
3. Mobility of spherical particles	25
3.1. Morphological characteristics of solid particles	25
3.2. Experiments on Brownian diffusion	26
3.2.1. Sample preparation	26
3.2.2. Observation methods	27
3.3. Diffusion coefficient evaluation (Brownian).....	28
3.4. Wall effect evaluation	29
3.5. Lateral migration	30
3.6. Evaluation of the focal depth.....	32
3.7. Results and discussion.....	33
3.7.1. Particle morphology	33
3.7.2. Hydrodynamic diameter for different types of particles	34
3.7.3. Ionic strength effect	39
3.7.4. Effect of ion size	42
3.7.5. Wall effect.....	44
3.7.6. Lateral migration of spherical particle	49
4. Mobility of highly deformable hydrogel nanofilaments	53
4.1. Morphology of core-shell nanofibres and hydrogel nanofilaments	53
4.2. Experiments on diffusion and channel flow	53
4.2.1. Brownian motion experiment.....	53

4.2.2. Filament flexibility measurements.....	55
4.2.3. Channel flow analysis.....	59
4.3. Filament mechanical properties evaluation.....	60
4.4. Orientation, elongation, and bending analysis methods.....	62
4.5. Cross-flow migration analysis.....	63
4.6. Results and discussion.....	64
4.6.1. Nanofilament morphology.....	64
4.6.2. Brownian motion of flexible nanofilaments.....	66
4.6.3. Evaluation of mechanical properties of hydrogel nanofilaments.....	71
4.6.4. Filament shape variation under flow interactions.....	74
4.6.5. Characteristic parameters of nanofilaments in a flow.....	78
4.6.6. Elongation and bending analysis.....	81
4.6.7. Orientation – inclination angle.....	85
4.6.8. Lateral migration of highly deformable nanofilaments.....	87
5. The possible use of hydrogel nanofilaments as controlled drug release systems	93
5.1. Samples preparation.....	93
5.2. Results and discussion.....	94
6. Conclusions	97
Bibliography	99