

Contents

1	Introduction	1
2	Background	5
2.1	Topical Drug Delivery	5
2.1.1	Structure of the Skin	5
2.1.2	Topical Medication	7
2.1.3	Polymeric Film-Forming Systems	10
2.2	Atomic Force Microscopy	11
2.2.1	Operating Modes for Imaging	12
2.2.2	Nanoindentation	12
2.2.3	AFM Imaging and Nanoindentation in Pharmaceuticals	13
2.3	Raman Spectroscopy	14
2.3.1	Raman Chemical Mapping	15
2.3.2	Raman Spectroscopy in Pharmaceuticals	16
2.4	Laser Poration	16
2.4.1	SC Penetration Enhancement Methods	16
2.4.2	Laser Ablation	17
2.4.3	Laser Poration of Skin	19
	References	23
3	Methodology	29
3.1	Film-Forming Systems	29
3.1.1	FFS Preparation	29
3.1.2	Atomic Force Microscopy Imaging	29
3.1.3	AFM Nanoindentation	32
3.1.4	Raman Micro-Spectroscopy	39
3.2	Laser Microporation	40
3.2.1	Preparation of Skin Samples	40
3.2.2	Laser Set-Up	41
3.2.3	Optical Microscopy	41

3.2.4	Raman Micro-Spectroscopy of Porcine Skin	42
3.2.5	Caffeine Delivery	43
	References	45
4	TEC Plasticization of Topical Polymeric Films	47
4.1	AFM Imaging	48
4.2	AFM Nanoindentation	51
4.2.1	Deformation Behaviour	51
4.2.2	Extraction of Elastic Modulus	56
4.3	Raman Micro-Spectroscopy.	60
4.3.1	Constituent Spectra	60
4.3.2	Mapping Concentration	61
4.3.3	Mapping the Physical State of the Drug	64
4.4	Film Formation on Skin	65
4.5	Summary and Conclusions	68
	References	69
5	Lipid Incorporation into Topical Polymeric Films	71
5.1	AFM Imaging	72
5.1.1	Interpretation of Tapping Mode Height	73
5.2	AFM Nanoindentation	76
5.2.1	Deformation Behaviour	76
5.2.2	Elastic Moduli	76
5.3	Raman Micro-Spectroscopy.	79
5.3.1	MCT Characteristic Spectral Features.	79
5.3.2	Mapping Concentration	80
5.3.3	Mapping the Physical State of the Drug	82
5.4	Drug Release Mechanism	83
5.5	Summary and Conclusions	84
	References	85
6	Laser Microporation of Skin	87
6.1	Pore Dimensions	88
6.1.1	Optical Microscopy of Laser Micropores	88
6.1.2	Variation of Pore Dimensions	90
6.1.3	Beam Propagation	91
6.1.4	Poration Using the Fibre Set-Up	95
6.2	Raman Micro-Spectroscopy.	97
6.2.1	Thermal Damage Detection.	97
6.2.2	Comparison of Pores in Inked and Uninked Skin	98
6.3	Permeation Enhancement	102
6.4	Mechanism of Ablation	104
6.5	Summary and Conclusions	105
	References	106

7 Conclusion. 109

7.1 Summary of Results. 109

7.2 Concluding Remarks 114

<http://www.springer.com/978-3-319-28900-7>

Novel (Trans)dermal Drug Delivery Strategies

Micro- and Nano-scale Assessments

Garvie-Cook, H.

2016, XVIII, 114 p. 49 illus., 24 illus. in color., Hardcover

ISBN: 978-3-319-28900-7