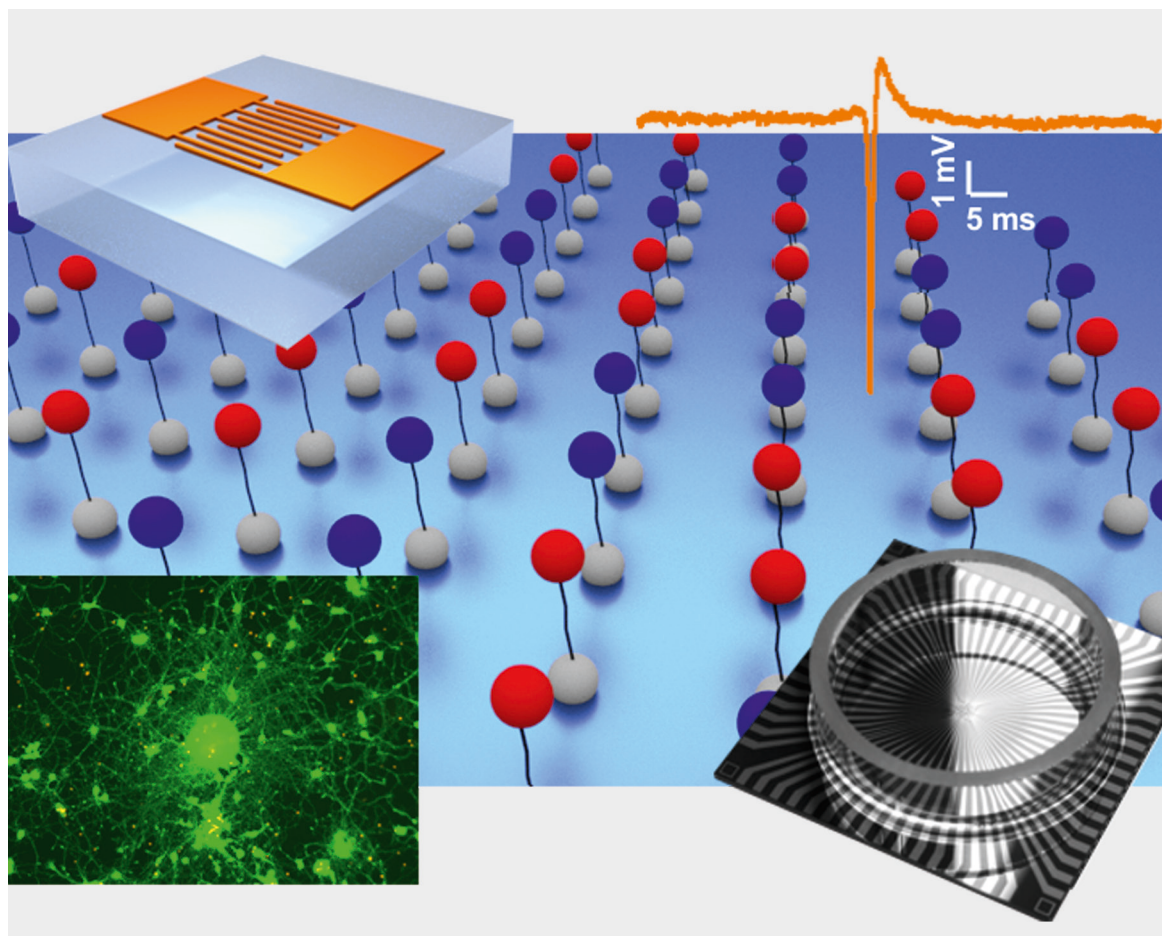




Tailoring and Characterisation of Bioelectronic Interfaces

Aleksandr Markov

Schlüsseltechnologien / Key Technologies

Band / Volume 162

ISBN 978-3-95806-298-6

Forschungszentrum Jülich GmbH
Institute of Complex Systems
Bioelectronics (ICS-8)

Tailoring and Characterisation of Bioelectronic Interfaces

Aleksandr Markov

Schriften des Forschungszentrums Jülich
Reihe Schlüsseltechnologien / Key Technologies

Band / Volume 162

ISSN 1866-1807

ISBN 978-3-95806-298-6

Contents

Zusammenfassung	4
Abstract	6
I. Introduction	8
II. Theoretical background and state of the art	11
II.1 MLD-state of the art.....	11
II.2 Self-assembled molecular monolayers	13
II.3 Molecular deposition techniques	15
II.4 MLD deposition	15
II.5 Molecular bonding interaction	16
II.6 Arrangement of molecules in a SAM	18
III. Experimental techniques and sample preparation.....	20
III.1 Choice of substrates and substrate preparation	20
III.1.1 Cleaning procedure	20
III.2 MLD	21
III.2.1 Silanization mechanism	21
III.2.2 MLD setup, automatization and deposition process	22
III.3 In-situ characterization methods	24
III.3.1 Capacitive sensor	24
III.3.2 Sensor preparation	26
III.4 Ex situ characterization methods.....	29
III.4.1 Electronic measurement of molecules in the liquid state	29
III.4.2 Ellipsometry	30
III.4.3 Contact angle measurements	33
III.4.4 Surface potential measurement	34
III.4.5 AFM.....	37
III.4.6 Fluorescence microscopy.....	39
III.5 Cell culturing	41
III.5.1 PLL preparation	41
III.5.2 Neuronal culture	41
III.5.3 HL-1 cell culture	42
III.5.4 Live-dead imaging	42
IV. Results and discussion	43

IV.1 In situ analysis of the growth and dielectric properties of organic SAMs	43
IV.1.1 In situ controlled SAM deposition	44
IV.1.2 Dielectric properties of SAMs	48
IV.2 Controlled engineering of oxide surfaces for bioelectronics applications using organic mixed monolayers	49
IV.2.1 Deposition of mixed molecular monolayers.....	50
IV.3 Engineering of cortical neurons growth density and enhancing MEA coupling via mixed SAMs ...	57
IV.2.1 PLL deposition on the mixed molecular SAMs	58
IV.2.2 Neuron growth density on mixed molecular SAMs.....	59
IV.2.3 Cell-chip communication	63
Summary	67
References	69
Erklärung	74
Lebenslauf	75

Schlüsseltechnologien / Key Technologies
Band / Volume 162
ISBN 978-3-95806-298-6