



Defect engineering in oxide thin films

Felix V. E. Hensling

Information

Band / Volume 59

ISBN 978-3-95806-424-9

Forschungszentrum Jülich GmbH
Peter Grünberg Institut (PGI)
Elektronische Materialien (PGI-7)

Defect engineering in oxide thin films

Felix V. E. Hensling

Schriften des Forschungszentrums Jülich
Reihe Information / Information

Band / Volume 59

ISSN 1866-1777

ISBN 978-3-95806-424-9

Contents

1	Introduction	1
2	Background	5
2.1	SrTiO ₃	5
2.1.1	Crystal structure	5
2.1.2	Defect chemistry	5
2.1.3	Electronic Structure	11
2.2	LaAlO ₃ /SrTiO ₃	12
2.3	Resistive Switching	14
3	Experimental methods	17
3.1	Sample preparation	17
3.2	The oxide cluster tool	18
3.2.1	Deposition techniques	18
3.2.2	Analysis techniques	27
3.3	Device Patterning	28
3.4	Electronic characterization	31
4	Influences on the defect structure	33
4.1	Anion stoichiometry	34
4.1.1	Enhanced oxygen vacancy formation at low pressures	34
4.1.2	UV-radiation of the plasma plume	47
4.1.3	The termination layer	56
4.1.4	Summary: Anion stoichiometry	67
4.2	Cation stoichiometry	68

5 Engineering SrTiO₃ for resistive switching	77
5.1 Role of the substrate termination and thin film stoichiometry	79
5.2 SrO interface engineering	86
5.2.1 Additional SrO at the bottom interface	86
5.2.2 Additional SrO at the top interface	94
5.3 Summary: Engineering SrTiO ₃ for resistive switching	102
6 Influence of the top electrode	103
6.1 Role of Carbon	103
6.2 Carbon patterns	120
7 Conclusion and outlook	127
7.1 Origin and engineering of defects	127
7.1.1 The origin of oxygen vacancies and how to tailor them	127
7.1.2 Cationic defect engineering	130
7.2 Impact of defects on the switching performance	131
Bibliography	141

Information
Band / Volume 59
ISBN 978-3-95806-424-9

Mitglied der Helmholtz-Gemeinschaft

