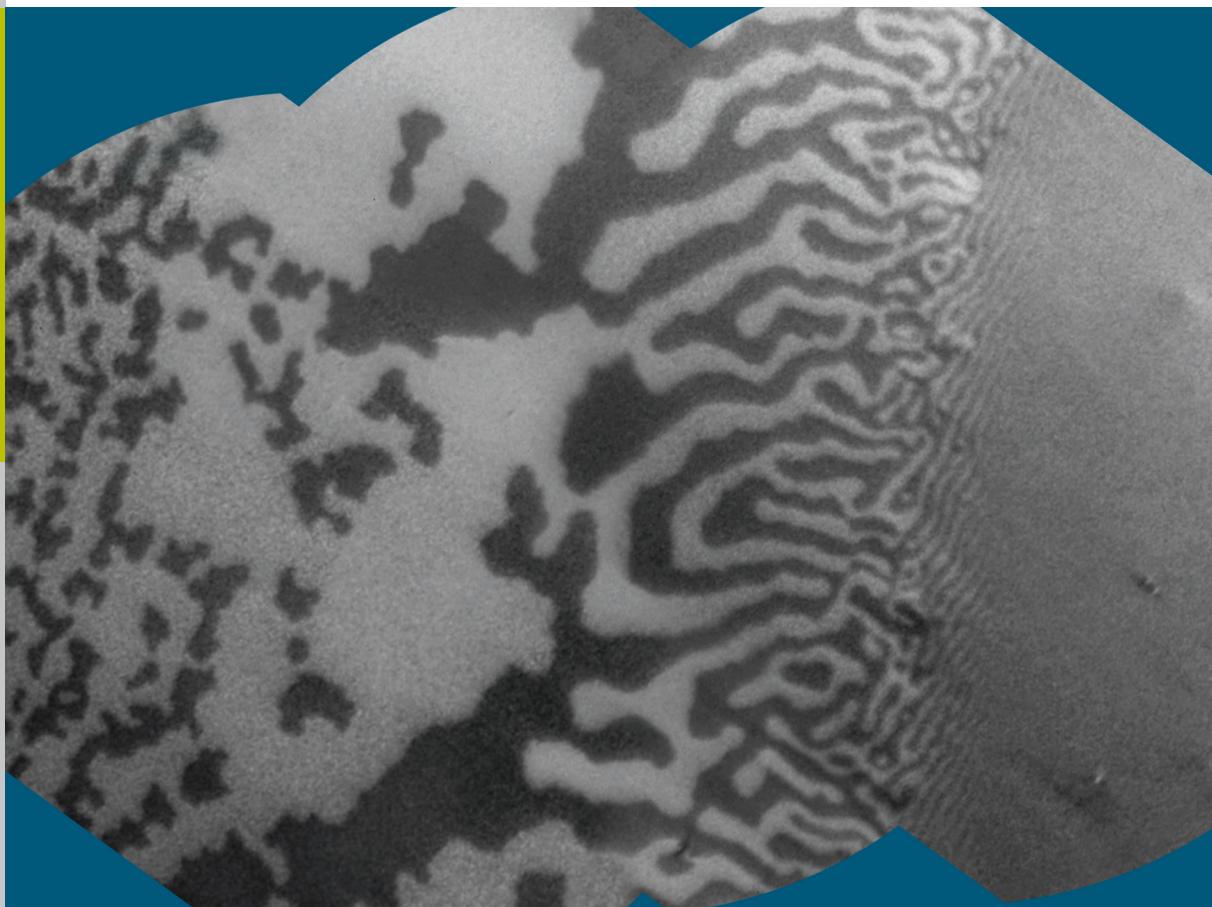


Spin-reorientation transition in epitaxial $\text{Ni}_x\text{Pd}_{1-x}$ films on Cu(001): a microscopic analysis

Daniel Marius Gottlob

Member of the Helmholtz Association



**Schlüsseltechnologien /
Key Technologies
Band / Volume 104
ISBN 978-3-95806-049-4**

 **JÜLICH**
FORSCHUNGSZENTRUM

Forschungszentrum Jülich GmbH
Peter Grünberg Institute (PGI)
Electronic Properties (PGI-6)

Spin-reorientation transition in epitaxial $\text{Ni}_x\text{Pd}_{1-x}$ films on Cu(001): a microscopic analysis

Daniel Marius Gottlob

Schriften des Forschungszentrums Jülich
Reihe Schlüsseltechnologien / Key Technologies

Band / Volume 104

ISSN 1866-1807

ISBN 978-3-95806-049-4

Contents

1	Introduction	1
2	Fundamental aspects	7
2.1	Magnetism	7
2.1.1	Stoner Model	7
2.1.2	Magnetism in transition metal alloys	10
2.1.3	Magnetic Anisotropy	12
2.1.4	Spin reorientation in uniaxial anisotropy model	16
2.2	Anisotropy and spin-reorientation transition in Ni/Cu(001)	18
2.3	Magnetic domains & domain walls	19
2.4	Photoemission process & XMCD	23
2.5	Electron inelastic mean free path	26
3	Experimental methods & setup	29
3.1	Preparation	30
3.1.1	Molecular beam epitaxy	30
3.1.2	AUGER electron spectroscopy (AES)	33
3.1.3	Low energy electron diffraction (LEED)	35
3.1.4	Medium energy electron diffraction (MEED)	36
3.2	Photoemission & low energy electron microscopy	37
3.2.1	Optics for immersion lens microscopy	38
3.2.2	Imaging modes	42
3.2.3	Generation of polarized x-rays	46
3.2.4	FE-LEEM-P90 at UE56/1-SGM	49
3.2.5	Determination of image rotations.	53
4	Sample preparation & characterization	55
4.1	Cu(001) substrate preparation	55
4.2	Ni/Cu(001) thin films	57

Contents

4.3	$\text{Ni}_x\text{Pd}_{1-x}/\text{Cu}(001)$ thin films	58
4.3.1	Preparation and characterization	58
4.3.2	Effects on lattice strain	59
5	Magnetic properties of Ni/Cu(001) and $\text{Ni}_x\text{Pd}_{1-x}/\text{Cu}(001)$	63
5.1	Ni/Cu(001) and Ni-like $\text{Ni}_x\text{Pd}_{1-x}/\text{Cu}(001)$	64
5.1.1	Ni/Cu(001)	64
5.1.2	Ni-like $\text{Ni}_x\text{Pd}_{1-x}$ films on Cu(001)	78
5.1.3	Summary Ni and Ni-like $\text{Ni}_x\text{Pd}_{1-x}$ films on Cu(001)	83
5.2	$\text{Ni}_x\text{Pd}_{1-x}/\text{Cu}(001)$ in higher Pd concentration	85
5.2.1	Thickness wedged $\text{Ni}_x\text{Pd}_{1-x}$	85
5.2.2	Composition wedged $\text{Ni}_x\text{Pd}_{1-x}$	87
5.2.3	Summary $\text{Ni}_x\text{Pd}_{1-x}$ films with higher Pd concentration	97
5.3	Domain patterns close to vanishing lattice mismatch	98
5.3.1	Continuous films in the vicinity of vanishing lattice mismatch	99
5.4	T_c drop at the spin-reorientation transition	100
6	Summary and outlook	103
Bibliography		107
Acknowledgements		125
Curriculum Vitae		129
List of own Publications		131

Schlüsseltechnologien /
Key Technologies
Band / Volume 104
ISBN 978-3-95806-049-4

