



Element-Selective Investigation of Femtosecond Spin Dynamics in $\text{Ni}_x\text{Pd}_{1-x}$ Magnetic Alloys using Extreme Ultraviolet Radiation

Seung-gi Gang

Information

Band / Volume 58

ISBN 978-3-95806-411-9

Forschungszentrum Jülich GmbH
Peter Grünberg Institut (PGI)
Elektronische Eigenschaften (PGI-6)

Element-Selective Investigation of Femtosecond Spin Dynamics in $\text{Ni}_x\text{Pd}_{1-x}$ Magnetic Alloys using Extreme Ultraviolet Radiation

Seung-gi Gang

Schriften des Forschungszentrums Jülich
Reihe Information / Information

Band / Volume 58

ISSN 1866-1777

ISBN 978-3-95806-411-9

Contents

Zusammenfassung	1
Abstract	3
1 Introduction	7
2 Fundamental Considerations	11
2.1 Magnetism	11
2.1.1 Magnetic Moment	11
2.1.2 Exchange Interaction	13
2.1.3 Ferromagnetism in 3d Transition Metals	16
2.1.4 Spin-Orbit Interaction	17
2.2 Properties of $\text{Ni}_x\text{Pd}_{1-x}$ alloys	19
2.3 Ultrafast Magnetization Dynamics	25
2.3.1 Elliot-Yafet mechanism and the Three Temperature Model	25
2.3.2 Superdiffusive Spin Transport	29
2.3.3 Optically-induced Intersite Spin Transfer	32
2.4 Magneto-Optical Kerr Effect(MOKE)	33
2.4.1 General Description	33
2.4.2 Transversal MOKE (T-MOKE)	35
2.5 Laser-Based High-Order Harmonics Generation	39
2.5.1 Three-Step Model	40
2.5.2 Phase-Matching	42
3 Sample Preparation and Characterization	45
3.1 Sample Fabrication	45
3.2 Longitudinal MOKE of $\text{Ni}_x\text{Pd}_{1-x}$ Alloys	48
3.3 Sample Reflectivity	48
3.3.1 Grating Reflectivity	49
3.3.2 Thin-Film Reflectivity	52
4 Experimental Setup	57
4.1 Laser System	58
4.2 XUV Beamline	60
4.2.1 Beam Stabilization System	60
4.2.2 XUV Light Source	63
4.2.3 Beamline Configurations	64
4.2.4 Bragg mirror	66

4.2.5	Toroidal mirror	66
4.3	Experimental Chamber and Signal Detection	69
4.3.1	Sample and Detector	69
4.3.2	Subpixel Shift Correction	69
4.3.3	Pump-Probe Technique	70
5	Experimental Results:	
	Element Selective Investigation of Dynamics in $\text{Ni}_x\text{Pd}_{1-x}$ Alloys	73
5.1	Static Magnetic Asymmetry of $\text{Ni}_x\text{Pd}_{1-x}$ Alloys	73
5.1.1	Magnetic Asymmetry of Pure Ni	74
5.1.2	Magnetic Asymmetry of $\text{Ni}_{0.8}\text{Pd}_{0.2}$	75
5.1.3	Static Measurements of Induced Magnetization in Pd	75
5.2	Spin Dynamics in $\text{Ni}_x\text{Pd}_{1-x}$ Alloys	80
5.2.1	Dynamics Comparison for Two Different Experimental Configurations	81
5.2.2	Element Selective Dynamics of the Ni and Pd Subsystems	82
5.2.3	Spin Dynamics in the Ni Subsystem with Constant Pump Fluence	84
5.2.4	Spin Dynamics in the Ni Subsystem with Constant Quenching	86
6	Summary and discussion	89
7	Outlook	93
Appendix		i
Abbreviations		v
Bibliography		vii
Publications and Conference Contributions		xv
Curriculum Vitae		xvii
Acknowledgements		xix

Information
Band / Volume 58
ISBN 978-3-95806-411-9

Mitglied der Helmholtz-Gemeinschaft

