

Literaturverzeichnis

- [1] Ch. Kittel, *Einführung in die Festkörperphysik*, Oldenbourg Verlag, München-Wien (1988).
- [2] E. P. Wohlfahrt, *Ferromagnetic Materials, Bd. 1*, North-Holland, Amsterdam (1980).
- [3] F. Keffer, *Handbuch der Physik, Vol. 18*, Springer, Berlin (1966).
- [4] A. H. Morrish, *The Physical Principles of Magnetism*, John Wiley and Sons, Inc., New York (1965).
- [5] W. Heisenberg, *Zur Theorie des Ferromagnetismus.* Z. Physik **49** (1928) 619.
- [6] S. Chikazumi, *Physics of Ferromagnetism*, Oxford University Press Inc., Oxford (1997).
- [7] P. V. Hendriksen, S. Linderoth und P.-A. Lindgård, *Finite-size modifications of the magnetic properties of clusters.* Phys. Rev. B **48** (1993) 7259.
- [8] U. Gradmann, *Surface magnetism.* J. Magn. Magn. Mater. **100** (1991) 481.
- [9] J. Guevara, F. Parisi, A. M. Llois und M. Weissmann, *Electronic properties of transition-metal clusters: Consideration of the spillover in a bulk parametrization.* Phys. Rev. B **55** (1997) 13283.
- [10] I. M. L. Billas, A. Châtelain und W. A. de Heer, *Magnetism of Fe, Co and Ni clusters in molecular beams.* J. Magn. Magn. Mater. **168** (1997) 64.
- [11] C. Kittel, *Theory of the structure of ferromagnetic domains in films and small particles.* Phys. Rev. **70** (1946) 965.
- [12] B. Heinrich, Z. Celinski, J. F. Cochran, A. S. Arrott und K. Myrtle, *Magnetic anisotropies in single and multilayered structures.* J. Appl. Phys. **70** (1991) 5769.

- [13] A. Aharoni, *Introduction to the Theory of Ferromagnetism*, Oxford University Press Inc., Oxford (1996).
- [14] A. Anisimov, W. Platow, P. Poulopoulos, W. Wisny, M. Farle, K. Baberschke, P. Isberg, B. Hjörvarsson und R. Wäppling, *The temperature-dependent in- and out-of-plane magnetic anisotropies in $Fe_n V_m(001)$ superlattices*. J. Phys.: Condens. Matter **9** (1997) 10581.
- [15] T. Hill, Magnetische Eigenschaften von Metallteilchen auf Isolatoroberfläche - Eine FMR Studie -, Dissertation, Ruhr-Universität Bochum. (1998).
- [16] S. V. Vonskovskii, *Ferromagnetic Resonance*, Pergamon Press Ltd., Headington Hill Hall, Oxford (1966).
- [17] C. Zener, *Classical theory of the temperature dependence of magnetic anisotropy energy*. Phys. Rev. **96** (1954) 1335.
- [18] W. J. Carr, *Temperature dependence of ferromagnetic anisotropy*. J. Appl. Phys. **29** (1958) 436.
- [19] H. B. Callen und E. Callen, *The present status of the temperature dependence of magnetocrystalline anisotropy, and the $l(l+1)/2$ power law*. J. Phys. Chem. Solids **27** (1966) 1271.
- [20] S. V. Vonskovskii, *Magnetism*, John Wiley and Sons, New York (1974).
- [21] M. Weber, R. Koch und K. H. Rieder, *UHV cantilever beam technique for quantitative measurements of magnetization, magnetostriction, and intrinsic stress of ultrathin magnetic films*. Phys. Rev. Lett. **73** (1994) 1166.
- [22] R. Koch, mündl. Mitteilung, Berlin. (1998).
- [23] R. Koch, *Magnetoelastische Kopplung in epitaktischen Dünnschichten*, Kapitel 3 in *Magnetische Schichtsysteme*, Institut für Festkörperforschung, Forschungszentrum Jülich GmbH (1997).
- [24] L. Néel, *Anisotropie magnétique superficielle et surstructures d'orientation*. J. Physique Rad. **15** (1954) 225.

- [25] V. P. Shilov, Yu. L. Raikher, J.-C. Bacri, F. Gazeau und R. Perzynski, *Effect of unidirectional anisotropy on the ferromagnetic resonance in ferrite nanoparticles.* Phys. Rev. B **60** (1999) 11902-11905.
- [26] C. P. Bean und J. D. Livingston, *Superparamagnetism.* J. Appl. Phys. **30** (1959) 120.
- [27] J. L. Dormann und D. Fiorani, *Magnetic Properties of Fine Particles*, North-Holland, Amsterdam (1992).
- [28] B. Heinrich und J.A.C. Blandt, *Ultra Magnetic Structures, I and II*, Springer, Berlin (1994).
- [29] J. Smit und H. G. Beljers, *Ferromagnetic resonance absorption in BaFe₁₂O₁₉, a highly anisotropic crystal.* Philips Res. Rep. **10** (1955) 113.
- [30] L. Baselgia, M. Warden, F. Waldner, S. L. Hutton, J. E. Drumheller, Y. Q. He, P. E. Wigen und M. Marysko, *Derivation of the resonance frequency from the free energy of ferromagnets.* Phys. Rev. B **38** (1988) 2237.
- [31] R. S. Gekht, V. A. Ignatchenko, Y. L. Raikher und M. I. Shliomis, *Magnetic resonance of an isotropic superparamagnet.* Sov. Phys. JETP **43** (1976) 677.
- [32] Y. L. Raikher und V. I. Stepanov, *The effect of thermal fluctuations on the FMR line shape in dispersed ferromagnets.* Sov. Phys. JETP **75** (1992) 764.
- [33] D. L. Griscom, *Ferromagnetic resonance of fine grained precipitates in glass: a thumb-nail review.* J. Non-Crystalline Solids **42** (1980) 287.
- [34] C. P. Poole, *Electron Spin Resonance*, John Wiley and Sons, New York (1983).
- [35] Z. Celinski, K. B. Urquhart und B. Heinrich, *Using ferromagnetic resonance to measure the magnetic moments of ultrathin film.* J. Magn. Magn. Mater. **166** (1997) 6.
- [36] C. Argile und G. E. Rhead, *Adsorbed layer and thin film growth modes monitored by Auger Electron Spectroscopy.* Surf. Sci. Rep. **10** (1989) 277.
- [37] C. T. Campbell, *Ultrathin metal films and particles on oxide surfaces: structural, electronic and chemisorptive properties.* Surf. Sci. Rep. **27** (1997) 1-111.

- [38] M. Bäumer, M. Frank, R. Kühnemuth, S. Stempel und H.-J. Freund, *Nucleation and growth of transition metals on thin alumina films.* Surf. Sci. **454** (2000) 957-962.
- [39] K. H. Hansen, T. Worren, S. Stempel, E. Lægsgaard, M. Bäumer, H.-J. Freund, F. Besenbacher und I. Stensgaard, *Palladium nanocrystals on Al_2O_3 : structure and adhesion energy.* Phys. Rev. Lett. **83** (1999) 4120-4123.
- [40] J. A. Venables, *Atomic processes in crystal growth.* Surf. Sci. **299** (1994) 798-817.
- [41] C. R. Henry, C. Chapon, S. Giorgio und C. Goyhenex, *Size effects in heterogeneous catalysis,* Kapitel 5 in *Chemisorption and Reactivity on Supported Clusters and Thin Films, Series E: Applied Sciences, Vol. 331, P. 117-15*, NATO ASI, Kluwer Academic Press, Dordrecht (1997).
- [42] C. R. Henry, *Surface studies of supported model catalysts.* Surf. Sci. Rep. **31** (1998) 231-325.
- [43] R. Wiesendanger, *Scanning Probe Microscopy and Spectroscopy*, Cambridge University Press (1994).
- [44] M. Henzler und W. Göpel, *Oberflächenphysik des Festkörpers*, B.G. Teubner, Stuttgart (1994).
- [45] J. Ohnsorge und R. Holm, *Rasterelektronenmikroskopie*, Georg Thieme Publishers, Stuttgart (1974).
- [46] T. Risse, Untersuchung der molekularen Dynamik selbstorganisierter Fettsäurefilme auf geordneten Oxidfilmen mittels ESR-Spektroskopie, Dissertation, Ruhr-Universität Bochum. (1996).
- [47] T. M. French und G. A. Somorjai, *Composition and surface structure of the (0001) face of α -alumina by Low-Energy Electron Diffraction.* J. Phys. Chem. **74** (1970) 2489.
- [48] G. Renaud, B. Villette, I. Vilfan und A. Bourret, *Atomic structure of the α - $Al_2O_3(0001)(\sqrt{3}\times\sqrt{3})R\pm9^\circ$ reconstruction.* Phys. Rev. Lett. **73** (1994) 1825.
- [49] C. Chang, *LEED studies of the (0001) face of α -alumina.* J. Appl. Phys. **39** (1968) 5570.

- [50] P. Guenard, G. Renaud, A. Barbier und M. Gautier-Soyer, *Determination of the $\alpha\text{-Al}_2\text{O}_3(0001)$ surface relaxation and termination by measurements of crystal truncation rods.* Mat. Res. Soc. Symp. Proc. **437** (1996) 15.
- [51] M. Klimenkov, Untersuchungen an metallischen Clustern auf einer $\text{Al}_2\text{O}_3/\text{NiAl}(110)$ -Oberfläche mit Transmissionselektronenmikroskopie, Dissertation, Ruhr-Universität Bochum. (1998).
- [52] M. Klimenkov, S. Nepijko, H. Kuhlenbeck, M. Bäumer, R. Schlögl und H.-J. Freund, *The structure of Pt-aggregates on a supported thin aluminum oxide film in comparison with unsupported alumina: a transmission electron microscopy study.* Surf. Sci. **391** (1997) 27.
- [53] S. Stempel, Nukleation, Wachstum und Struktur kleiner Metallpartikel auf einer geordneten Aluminiumoxidunterlage, Dissertation, Freie Universität Berlin. (1998).
- [54] M. Bäumer, J. Libuda und H.-J. Freund, *Metal deposits on thin well ordered oxide films: morphology, adsorption and reactivity,* Kapitel 3 in *Chemisorption and Reactivity on Supported Clusters and Thin Films*, NATO ASI Ser. E, Kluwer Academic Press, Dordrecht (1997).
- [55] J. Wertz und J. Bolton, *Electron Spin Resonance*, Chapman and Hall, New York, London (1986).
- [56] G. Beitel, K. Markert, J. Wiechers, J. Hrbek und R. J. Behm, *Characterization of single-crystal $\alpha\text{-Al}_2\text{O}_3(0001)$ and $(1\bar{1}\bar{2}0)$ surfaces and Ag/ Al_2O_3 model catalysts by Atomic Force Microscopy,* Kapitel 3 in *Adsorption on Ordered Surfaces of Ionic Solids and Thin Films*, Springer, Berlin-Heidelberg (1993).
- [57] O. Kurnosikov, L. Pham Van und J. Cousty, *About anisotropy of atomic-scale height step on (0001) sapphire surface.* Surf. Sci. **459** (2000) 256-264.
- [58] R. Baxter, P. Reinhard, N. Lopez und F. Illas, *The extent of relaxation of the $\alpha\text{-Al}_2\text{O}_3(0001)$ surface and the reliability of empirical potentials.* Surf. Sci. **445** (2000) 448-460.
- [59] M. Gautier, J. P. Durand, L. Pham Van und M. J. Guittet, *Modifications of $\alpha\text{-Al}_2\text{O}_3(0001)$ surfaces induced by thermal treatments or ion bombardment.* Surf. Sci. **250** (1991) 71.

- [60] M. Gautier, G. Renaud, L. Pham Van, B. Villette, M. Pollak, N. Thromat, F. Jollet und J.-P. Duraud, *α -Al₂O₃(0001) surfaces: atomic and electronic structure.* J. Am. Ceram. Soc. **77** (1994) 323.
- [61] M. A. Schildbach und A. V. Hamza, *Sapphire (11 $\bar{2}$ 0) surface: Structure and laser-induced desorption of aluminum.* Phys. Rev. B **45** (1992) 6197.
- [62] I. Vilfan, F. Lancon und J. Villain, *Rotational reconstruction of sapphire (0001).* Surf. Sci. **392** (1997) 62.
- [63] C. L. Pang, H. Raza, S. A. Haycock und G. Thornton, *Growth of copper and palladium on α -Al₂O₃(0001).* Surf. Sci. **460** (2000) 510-514.
- [64] T. Hsu und Y. Kim, *Structure of the α -Al₂O₃(11-20) surfaces: facets and reconstruction.* Surf. Sci. **258** (1991) 119-130.
- [65] C. Barth, Private Mitteilung. (2001).
- [66] L. Vitos, A. V. Ruban, H. L. Skriver und J. Kollár, *The surface energy of metals.* Surf. Sci. **411** (1998) 186-202.
- [67] S. Tanuma, C. J. Powell und D. R. Penn, *Calculations of electron inelastic mean free paths, III. Data for 15 inorganic compounds over the 50-2000 eV range.* Surf. and Interface Anal. **17** (1991) 927-939.
- [68] S. Tanuma, C. J. Powell und D. R. Penn, *Calculations of electron inelastic mean free paths, II. Data for 27 elements over the 50-2000 eV range.* Surf. and Interface Anal. **17** (1991) 911-926.
- [69] H. Poppa, C. A. Papageorgopoulos, F. Marks und E. Bauer, *Growth and properties of particulate Fe films vapor deposited in UHV on planar alumina substrates.* Z. Phys. D- Atoms, Molecules and Clusters **3** (1986) 279-289.
- [70] H. Poppa, C. A. Papageorgopoulos und E. Bauer, *The low-rate growth of particle Fe on planar alumina supports.* Ultramicroscopy **20** (1986) 145-150.
- [71] E. G. Seebauer und C. E. Allen, *Estimating surface diffusion coefficients.* Progr. Surf. Sci. **49** (1995) 265-330.
- [72] S. Bagdonat und W. Göpel, *Ferromagnetische Resonanz dünner Nickel-Aufdampfschichten.* Z. Phys. Chem. NF **87** (1973) 11-22, 23-39.

- [73] C. J. Sparks, M. Hasaka, D. S. Easton, S. Baik, T. Habenschuss und G. E. Ice, *Structural studies of Nickel films and their interface with sapphire substrates.* Mat. Res. Soc. Symp. Proc. **77** (1987) 495-502.
- [74] Y. Li und K. Baberschke, *Anisotropy energies and critical behavior of ultrathin Ni(111) films grown on smooth and rough W(110).* Mat. Res. Soc. Symp. Proc. **231** (1992) 289.
- [75] Y. Li und K. Baberschke, *Dimensional crossover in ultrathin Ni(111) films on W(110).* Phys. Rev. Lett. **68** (1992) 1208.
- [76] W. Platow, A. N. Anisimov, G. L. Dunifer, M. Farle und K. Baberschke, *Correlation between ferromagnetic-resonance linewidths and sample quality in the study of metallic ultrathin films.* Phys. Rev. B **58** (1998) 5611.
- [77] M. B. Stearns, Edited by H. P. J. Wijn und Landolt-Börnstein, *Magnetic Properties of Metals, Vol. III/19a*, Springer, Berlin (1986).
- [78] J. L. Bubendorff, J. Pflaum, E. Huebner, D. Raiser, J. P. Bucher und J. Pelzl, *Correlation between topographic and magnetic properties of electrochemically prepared nickel films.* J. Magn. Magn. Mater. **165** (1997) 199-201.
- [79] Y. Li, M. Farle und K. Baberschke, *Ferromagnetic resonance in ultrathin Ni(111)/W(110).* J. Magn. Magn. Mat. **93** (1991) 345-348.
- [80] W. Platow, Magnetismus und Struktur ultradünner ferromagnetischer Filme der 3d-Übergangsmetalle: Ferromagnetische Resonanz im Ultrahochvakuum, Dissertation, Freie Universität Berlin. (1999).
- [81] M. T. Johnson, P. J. H. Bloemen, F. J. A. den Broeder und J. J. de Vries, *Magnetic anisotropy in metallic multilayers.* Rep. Prog. Phys. **59** (1996) 1409.
- [82] S. S. Dhesi, H. A. Dürr, und G. van der Laan, *Canted spin structures in Ni films on stepped Cu(001).* Phys. Rev. B **59** (1999) 8408-8411.
- [83] K. Baberschke, *The magnetism of nickel monolayers.* Appl. Phys. A **62** (1996) 417-427.
- [84] W. L. O'Brien und B. P. Tonner, *Transition to the perpendicular easy axis of magnetization in Ni ultrathin films found by x-ray magnetic circular dichroism.* Phys. Rev. B **49** (1994) 15370.

- [85] M. Farle, W. Platow, A. N. Anisimov, P. Poulopoulos und K. Baberschke, *Anomalous reorientation phase transition of magnetization in fct Ni/Cu(001)*. Phys. Rev. B **56** (1997) 5100.
- [86] S. Z. Wu, G. J. Mankey und R. F. Willis, *Effect of substrate symmetry on the preferred magnetization orientation of Ni films on Cu*. J. Vac. Sci. Technol. A **13** (1995) 1497-1500.
- [87] R. Q. Wu, L. J. Chen und A. J. Freeman, *First principles determination of magnetostriction in bulk transition metals and thin films*. J. Magn. Magn. Mat. **170** (1997) 103-109.
- [88] Landolt-Börnstein, *Zahlenwerte und Funktionen, IV. Band, Wärme Technik*, Springer, Berlin (1966).
- [89] F. Gerhardter, Y. Li und K. Baberschke, *Temperature-dependent ferromagnetic-resonance study in ultrahigh vacuum: Magnetic anisotropies of thin iron films*. Phys. Rev. B **47** (1993) 11204.
- [90] Y. Park, S. Adenwalla, G. P. Felcher und S. D. Bader, *Superparamagnetic relaxation of Fe deposited on MgO(001)*. Phys. Rev. B **52** (1995) 12779-1278.
- [91] F. Schmidt und T. Meeder, *A magnetic resonance of Ni clusters supported on X-Zeolite - An analysis of the linewidth and the determination of the Curie temperature*. Surf. Sci. **106** (1981) 397-402.
- [92] T. Isobe, R. A. Weeks und R. A. Zuhr, *Magnetic properties of nanosize nickel particles produced in silica glasses by ion implantation and subsequent annealing*. Solid State Commun. **105** (1998) 469-472.
- [93] A. A. Andreev und P. W. Selwood, *Ferromagnetic resonance of supported nickel with adsorbed hydrogen, oxygen, and ethylene*. J. Catal. **8** (1967) 375-382.
- [94] W. Nolting, *Grundkurs: Theoretische Physik, Bd. 4*, Zimmermann-Neufang, Ulmen (1993).
- [95] G. Renaud, *Oxide surfaces and metal/oxide interfaces studied by grazing incidence X-ray scattering*. Surf. Sci. Rep. **32** (1998) 1-90.

- [96] T. Suzuki, S. Hishita, K. Oyoshi und R. Souda, *Initial stage growth mechanisms of metal adsorbates -Ti, Zr, Fe, Ni, Ge, and Ag -on MgO(001) surface.* Surf. Sci. **442** (1999) 291.
- [97] A. Berger, B. Feldmann, H. Zillgen und M. Wuttig, *Correlation between the microscopic and macroscopic magnetic properties in ultrathin Fe/Cu(100) films.* J. Magn. Magn. Mater. **183** (1998) 35-41.
- [98] S. Müller, P. Bayer, C. Reischl, K. Heinz, B. Feldmann, H. Zillgen und M. Wuttig, *Structural instability of ferromagnetic fcc Fe films on Cu(100).* Phys. Rev. Lett. **74** (1996) 765-768.
- [99] D. Li, M. Freitag, J. Pearson, Z. Q. Qui und S. D. Bader, *Magnetic phases of ultrathin Fe grown on Cu(100) as epitaxial wedges.* Phys. Rev. Lett. **72** (1994) 3112-3115.
- [100] V. L. Moruzzi, P. M. Marcus, K. Schwarz und P. Mohn, *Ferromagnetic phases of bcc and fcc Fe, Co, and Ni.* Phys. Rev. B **34** (1986) 1784-1791.
- [101] H. Ofuchi, T. Kubo, N. Matsumoto, M. Tabuchi, Y. Takeda, Y. Yamada und M. Matsui, *Local structures around Fe atoms and magnetic properties of [fcc-Fe/Cu] multilayers.* Appl. Surf. Sci. **130** (1998) 899-903.
- [102] T. Hill, M. Mozaffari-Afshar, J. Schmidt, T. Risze, S. Stempel, M. Heemeier und H.-J. Freund, *Influence of CO adsorption on the magnetism of small Co particles deposited on Al₂O₃.* Chem. Phys. Lett. **292** (1998) 524-530.
- [103] T. Hill, M. Mozaffari-Afshar, J. Schmidt, T. Risze und H.-J. Freund, *Changes in the magnetism of small supported cobalt particles during the oxidation process observed by ferromagnetic resonance.* Surf. Sci. **429** (1999) 246-254.
- [104] T. Hill, S. Stempel, T. Risze, M. Bäumer und H.-J. Freund, *FMR studies on ultrathin metallic films grown on Al₂O₃ surfaces.* J. Magn. Magn. Mater. **198** (1999) 354-356.
- [105] Landolt-Börnstein, *Zahlenwerte und Funktionen, Gruppe II, Band 2*, Springer, Berlin (1966).
- [106] F. Gazeau, V. Shilov, J. C. Bacri, E. Dubois, F. Gendron, R. Perzynski, Yu. L. Raikher und V.I. Stepanov, *Magnetic resonance of nanoparticles in a ferrofluid: evidence of thermofluctuational effect.* J. Magn. Magn. Mater. **202** (1999) 535-546.

- [107] W. Weiss und M. Ritter, *Metal oxide heteroepitaxy: Stranski-Krastanov growth for iron oxides on Pt(111)*. Phys. Rev. B **59** (1999) 5201-5213.
- [108] B. Stanka, W. Hebenstreit, U. Diebold und S. A. Chambers, *Surface reconstruction of Fe₃O₄(001)*. Surf. Sci. **448** (2000) 49-63.
- [109] Y. J. Kim, Y. Gao und S. A. Chambers, *Selective growth and characterization of pure, epitaxial α-Fe₂O₃ und Fe₃O₄ films by plasma-assisted molecular beam*. Surf. Sci. **371** (1997) 358-370.
- [110] Y. Gao, Y. J. Kim, S. A. Chambers und G. Bai, *Synthesis of epitaxial films of Fe₃O₄ and α-Fe₂O₃ with various low-index orientations by oxygen-plasma-assisted molecular beam epitaxy*. J. Vac. Sci. Technol. A **15** (1997) 332-339.
- [111] P. A. A. van der Heijden, M. G. van Opstal, C. H. W. Swüste, P. H. J. Bloemen und W. J. M. de Jonge, *A ferromagnetic resonance study on ultra-thin Fe₃O₄ layers grown on (001) MgO*. J. Magn. Magn. Mater. **182** (1998) 71-80.
- [112] T. Wenzel, J. Bosbach, F. Stietz und F. Träger, *In situ determination of the shape of supported silver clusters during growth*. Surf. Sci. **432** (1999) 257-264.
- [113] N. Moumen und M. P. Pileni, *Control of the size of cobalt ferrite magnetic fluid*. J. Phys. Chem. **100** (1996) 1867-1873.
- [114] M. R. Diehl, J.-Y. Yu, J. R. Heath, G. A. Held, H. Doyle, S. Sun und C. B. Murray, *Crystalline, shape, and surface anisotropy in two crystal morphologies of superparamagnetic cobalt nanoparticles by ferromagnetic resonance*. J. Phys. Chem. B **105** (2001) 7913-7919.
- [115] S. E. Apsel, J. W. Emmert, J. Deng und L. A. Bloomfield, *Surface-enhanced magnetism in nickel cluster*. Phys. Rev. Lett. **76** (1996) 1441-1444.
- [116] D. L. Griscom, *Ferromagnetic resonance condition and powder pattern analysis for dilute, spherical, single-domain particles of cubic crystal structure*. J. Magn. Res. **45** (1981) 81.
- [117] B. Schulz, Magnetische Eigenschaften ultradünner Ni/Cu(001)-Filme: Eine Untersuchung mittels ferromagnetischer Resonanz im UHV, Dissertation, Freie Universität Berlin. (1995).