

REFERENCES

References

- [1] Agarwal B.K., *X-Ray Spectroscopy* (Springer, Berlin, 1979).
- [2] Ager J.W., Anders S., Brown I.G., Nastasi M., Walter K.C., "Multilayer hard carbon films with low wear rates", *Surf. Coat. Technol.* **91**, 91-94 (1997).
- [3] Aisenberg S., Chabot R., "Ion-beam deposition of thin films of diamondlike carbon", *J. Appl. Phys.* **42**, 2953-2958 (1971).
- [4] Alexandrov A.L., Schweigert I.V., "Two-dimensional PIC-MCC simulations of a capacitively coupled radio frequency discharge in methane", *Plasma Sources Sci. Technol.* **14**, 209-218 (2005).
- [5] Anders A., *Handbook of plasma immersion ion implantation and deposition* (John Wiley & Sons, New York, 2000).
- [6] Andújar J.L., Pascual E., Viera G., Bertran E., "Optical emisión spectroscopy of rf glow discharges of methane-silane mixtures", *Thin Solid Films* **317**, 120-123 (1998).
- [7] Andújar J.L., Pino F.J., Polo M.C., Pinyol A., Corbella C., Bertran E., "Effects of gas pressure and r.f. power on the growth and properties of magnetron sputter deposited amorphous carbon thin films", *Diamond Relat. Mater.* **11**, 1005-1009 (2002).
- [8] Andújar J.L., Vives M., Corbella C., Bertran E., "Growth of hydrogenated amorphous carbon films in pulsed d.c. methane discharges", *Diamond Relat. Mater.* **12**, 98-104 (2003).
- [9] Arvieu C., Manaud J.P., Quenisset J.M., "Interaction between titanium and carbon at moderate temperatures", *J. Alloys Comp.* **368**, 116-122 (2004).
- [10] Baranov A.M., Sleptsov V.V., Nefedov A.A., Varfolomeev A.E., Calliari L., "Real time investigation of the initial stages of a-C films growth", *Diamond Relat. Mater.* **13**, 1356-1360 (2004).
- [11] Beake B.D., Hassan I.U., Rego C.A., Ahmed W., "Friction force microscopy study of diamond films modified by a glow discharge treatment", *Diamond Relat. Mater.* **9**, 1421-1429 (2000).
- [12] Berg S., Nyberg T., "Fundamental understanding and modelling of reactive sputtering processes", *Thin Solid Films* **476**, 215-230 (2005).
- [13] Bertran E., Corbella C., Pinyol A., Vives M., Andújar J.L., "Comparative study of metal/amorphous-carbon multilayer structures produced by magnetron sputtering", *Diamond Relat. Mater.* **12**, 1008-1012 (2003).
- [14] Bewilogua K., Cooper C.V., Specht C., Schröder J., Wittorf R., Grischke M., "Erratum to: 'Effect of target material on deposition and properties of metal-containing DLC (Me-DLC) coatings'", *Surf. Coat. Technol.* **132**, 275-283 (2000).
- [15] Bewilogua K., Wittorf R., Thomsen H., Weber M., "DLC based coatings prepared by reactive d.c. magnetron sputtering", *Thin Solid Films* **447-448**, 142-147 (2004).
- [16] Bhushan B., "Chemical, mechanical and tribological characterization of ultra-thin and hard amorphous carbon coatings as thin as 3.5 nm: recent developments", *Diamond Relat. Mater.* **8**, 1985-2015 (1999a).
- [17] Bhushan B., *Principles and Applications of Tribology* (John Wiley & Sons, New York, 1999b).

- [18] Blau P.J., "The significance and use of the friction coefficient", *Tribol. Inter.* **34**, 585-591 (2001).
- [19] Bradley J.W., Bäcker H., Kelly P.J., Arnell R.D., "Space and time resolved Langmuir probe measurements in a 100 kHz pulsed rectangular magnetron system", *Surf. Coat. Technol.* **142-144**, 337-341 (2001).
- [20] Cahn J.W., Hilliard J.E., "Free energy of a nonuniform system. I. Interfacial free energy", *J. Chem. Phys.* **28**, 258-267 (1958).
- [21] Cahn J.W., "Spinodal decomposition", *Trans. Metall. Soc. AIME* **242**, 166-180 (1968).
- [22] Cali F.A., Herbert P.A.F., Kelly W.M., "Automated Langmuir probe characterization of methane/hydrogen low-pressure radio frequency discharges in a production reactor", *J. Vac. Sci. Technol. A* **13**, 2920-2923 (1995).
- [23] Canillas A., Pascual E., Drévilon B., "Phase-modulated ellipsometer using a Fourier transform infrared spectrometer for real time applications", *Rev. Sci. Instrum.* **64**, 2153-2159 (1993).
- [24] Casiraghi C., Ferrari A.C., Ohr, R., Chu D., Robertson J., "Surface properties of ultra-thin tetrahedral amorphous carbon films for magnetic storage technology", *Diamond Relat. Mater.* **13**, 1416-1421 (2004).
- [25] Chapman B., *Glow discharge processes* (John Wiley & Sons, New York, 1980).
- [26] Chen J.S., Lau S.P., Sun Z., Chen G.Y., Li Y.J., Tay B.K., Chai J.W., "Metal-containing amorphous carbon films for hydrophobic application", *Thin Solid Films* **398-399**, 110-115 (2001).
- [27] Chen L.Y., Hong F.C.N., "Diamond-like carbon nanocomposite films", *Appl. Phys. Lett.* **82**, 3526-3528 (2003).
- [28] Cherry R.I., Whitmore T.D., "The measurement of electron energy distribution functions in methane-hydrogen plasmas", *Diamond Relat. Mater.* **4**, 524-527 (1995).
- [29] Chhowalla M. in: Silva S.R.P. (ed.), *Properties of Amorphous Carbon* (INSPEC, The Institution of Electrical Engineers, London, 2003).
- [30] Clay K.J., Speakman S.P., Morrison N.A., Tomozeiu N., Milne W.I., Kapoor A., "Material properties and tribological performance of rf-PECVD deposited DLC coatings", *Diamond Relat. Mater.* **7**, 1100-1107 (1998).
- [31] Corbella C., Echebarria B., Ramírez-Piscina L., Pascual E., Andújar J.L., Bertran E., "Spontaneous formation of nanometric multilayers of metal-carbon films by up-hill diffusion during growth", *Appl. Phys. Lett.* (in press).
- [32] Corbella C., Oncins G., Gómez M.A., Polo M.C., Pascual E., García-Céspedes J., Andújar J.L., Bertran E., "Structure of diamond-like carbon films containing transition metals deposited by reactive magnetron sputtering", *Diamond Relat. Mater.* **14**, 1103-1107 (2005a).
- [33] Corbella C., Pascual E., Canillas A., Bertran E., Andújar J.L., "Visible and infrared ellipsometry applied to the study of metal-containing diamond-like carbon coatings", *Thin Solid Films* **455-456**, 370-375 (2004a).
- [34] Corbella C., Pascual E., Gómez M.A., Polo M.C., García-Céspedes J., Andújar J.L., Bertran E., "Characterization of diamond-like carbon thin films produced by pulsed-DC low pressure plasma monitored by a Langmuir probe in time-resolved mode", *Diamond Relat. Mater.* **14**, 1062-1066 (2005b).

- [35] Corbella C., Pascual E., Oncins G., Canal C., Andújar J.L., Bertran E., "Composition and morphology of metal-containing diamond-like carbon films obtained by reactive magnetron sputtering", *Thin Solid Films* **482**, 293-298 (2005c).
- [36] Corbella C., Polo M.C., Oncins G., Pascual E., Andújar J.L., Bertran E., "Time-resolved electrical measurements of a pulsed-dc methane discharge used in diamond-like carbon films production", *Thin Solid Films* **482**, 172-176 (2005d).
- [37] Corbella C., Vives M., Oncins G., Canal C., Andújar J.L., Bertran E., "Characterization of DLC films obtained at room temperature by pulsed-dc PECVD", *Diamond Relat. Mater.* **13**, 1494-1499 (2004b).
- [38] Corbella C., Vives M., Pinyol A., Bertran E., Canal C., Polo M.C., Andújar J.L., "Preparation of metal (W, Mo, Nb, Ti) containing a-C:H films by reactive magnetron sputtering", *Surf. Coat. Technol.* **177-178**, 409-414 (2004c).
- [39] Dahan I., Admon U., Frage N., Sariel J., Dariel M.P., "Diffusion in Ti/TiC multilayer coatings", *Thin Solid Films* **377-378**, 687-693 (2000).
- [40] Daruka I., Tersoff J., "Self-assembled superlattice by spinodal decomposition during growth", *Phys. Rev. Lett.* **95**, 076102-1 – 4 (2005).
- [41] Deguchi M., Itatani R., "On the effect of film deposition on probe surface in measurement by the insulated pulsed probe method", *Jpn. J. Appl. Phys.* **41**, 352-361 (2002).
- [42] Dekempeneer E.H.A., Meneve J., Smeets J., "Diamond-like carbon coatings prepared in an asymmetric bipolar pulsed d.c. plasma", *Surf. Coat. Technol.* **120-120**, 692-696 (1999).
- [43] Dimigen H., Hübsch H., Memming R., "Tribological and electrical properties of metal-containing hydrogenated carbon films", *Appl. Phys. Lett.* **50**, 1056-1058 (1987).
- [44] Donnet C., Mogne T.L., Ponsonnet L., Belin M., Grill A., Patel V., Jahnes C., "The respective role of oxygen and water vapour on the tribology of hydrogenated diamond-like carbon coatings", *Tribol. Lett.* **4**, 259-265 (1998).
- [45] Egerton R.F., Malac M., "EELS in the TEM", *J. Electron Spectrosc. Rel. Phenom.* **143**, 43-50 (2005).
- [46] Ekimov E.A., Sidorov V.A., Bauer E.D., Melnik N.N., Curro, N.J., Thompson J.D., Stishov S.M., "Superconductivity in diamond", *Nature* **428**, 542-545 (2004).
- [47] Erdemir A., Eryilmaz O.L., Nilufer I.B., Fenske G.R., "Effect of source gas chemistry on tribological performance of diamond-like carbon films", *Diamond Relat. Mater.* **9**, 632-637 (2000).
- [48] Fallon P.J., Veerasamy V.S., Davis C.A., Robertson J., Amaratunga G.A.J., W.I. Milne, Koskinen J., "Properties of filtered-ion-beam-deposited diamondlike carbon as a function of ion energy", *Phys. Rev. B* **48**, 4777-4782 (1993).
- [49] Fermi E., "On the Origin of the Cosmic Radiation", *Phys. Rev.* **75**, 1169-1174 (1949).
- [50] Ferrari A.C., Robertson J., "Interpretation of Raman spectra of disordered and amorphous carbon", *Phys. Rev. B* **61**, 14095-14107 (2000).
- [51] Ferrari A.C., Robertson J., "Raman spectroscopy of amorphous, nanostructured, diamond-like carbon, and nanodiamond", *Phil. Trans. R. Soc. Lond. A* **362**, 2477-2512 (2004).
- [52] Friedman L.H., Chrzan D.C., "Scaling theory of the Hall-Petch relation for multilayers", *Phys. Rev. Lett.* **81**, 2715-2718 (1998).

- [53] Gåhlin R., Larsson M., Hedenqvist, P., "ME-C:H coatings in motor vehicles", *Wear* **249**, 302-309 (2001).
- [54] García-Caurel E., Bertran E., Canillas A., "Optimized calibration method for Fourier transform infrared phase-modulated ellipsometry", *Thin Solid Films* **354**, 187-194 (1999).
- [55] Gerstner E.G., McKenzie D.R., "Nonvolatile memory effects in nitrogen doped tetrahedral amorphous carbon thin films", *J. Appl. Phys.* **84**, 5647-5651 (1998).
- [56] Geyang L., Junhua X., Liuqiang Z., Liang W., Mingyuan G., "Growth, microstructure, and microhardness of W/Mo nanostructured multilayers", *J. Vac. Sci. Technol. B* **19**, 94-97 (2001).
- [57] Glocker D.A., "Influence of the plasma on substrate heating during low-frequency reactive sputtering of AlN", *J. Vac. Sci. Technol. A* **11**, 2989-2993 (1993).
- [58] Gogolides E., Mary D., Rhallabi A., Turban G., "RF plasmas in methane: prediction of plasma properties and neutral radical densities with combined gas-phase physics and chemistry model", *Jpn. J. Appl. Phys.* **34**, 261-270 (1995).
- [59] Gozadinos G., PhD Thesis "Collisionless heating and particle dynamics in radio-frequency capacitive plasma sheaths" (Dublin City University, Dublin, 2001).
- [60] Grischke M., Herb R., Massler O., Karner J., Eberle H., "High vacuum based deposition of carbon-based films for industrial applications", *44th Annual Technical Conference Proceedings*, 407 (2001).
- [61] Hall E.O., "The deformation and ageing of mild steel: III discussion of results", *Proc. Phys. Soc. London Sect. B* **64**, 747-753 (1951).
- [62] Hallil A., Despax B., "Internal r.f. plasma parameters correlated with structure and properties of deposited hydrocarbon films", *Thin Solid Films* **358**, 30-39 (2000).
- [63] Harry E., Rouzaud A., Juliet P., Pauleau Y., "General properties and scratch adhesion characterization of carbon-containing tungsten films", *Surf. Coat. Technol.* **116-119**, 81-85 (1999).
- [64] Hauert R., "An overview on the tribological behaviour of diamond-like carbon in technical and medical applications", *Tribol. Internat.* **37**, 991-1003 (2004).
- [65] Hauert R., Patscheider J., "From alloying to nanocomposites – Improved performance of hard coatings", *Adv. Eng. Mater.* **2**, 247-259 (2000).
- [66] Herrebout D., Bogaerts A., Yan M., Gijbels R., Goedheer W., Dekempeneer E., "One-dimensional fluid model for an rf methane plasma of interest in deposition of diamond-like carbon layers", *J. Appl. Phys.* **90**, 570-579 (2001).
- [67] Hovsepian, P.Eh., Lewis D.B., Münz W.-D., "Recent progress in large scale manufacturing of multilayer/superlattice hard coatings", *Surf. Coat. Technol.* **133-134**, 166-175 (2000).
- [68] Huang Q.F., Yoon S.F., Rusli, Yang H., Gan B., Chew K., Ahn J., "Conduction mechanism in molybdenum-containing diamond-like carbon deposited using electron cyclotron resonance chemical vapour deposition", *J. Appl. Phys.* **88**, 4191-4195 (2000).
- [69] Iijima S., "Helical microtubules of graphitic carbon", *Nature* **354**, 56-57 (1991).
- [70] Jacobsohn L.G., Freire F.L., "Influence of the plasma pressure on the microstructure and on the optical and mechanical properties of amorphous carbon films deposited by direct current magnetron sputtering", *J. Vac. Sci. Technol. A* **17**, 2841-2849 (1999).

- [71] James R.W., *The Optical Principles of the Diffraction of X-Rays* (Ox Bow Press, Woodbridge, 1962).
- [72] Jiang X., Zou J.W., Reichelt K., Grünberg P., „The study of mechanical properties of a-C:H films by Brillouin scattering and ultralow load indentation”, *J. Appl. Phys.* **66**, 4729-4735 (1989).
- [73] Joshi A., Gangal S.A., Kulkarni S.K., “Structure and properties of diamondlike carbon coatings deposited in rf plasma from benzene and monosubstituted benzenes”, *J. Appl. Phys.* **64**, 6668-6672 (1988).
- [74] Kim H., McIntyre P.C., “Spinodal decomposition in amorphous metal-silicate thin films: Phase diagram analysis and interface effects on kinetics”, *J. Appl. Phys.* **92**, 5094-5102 (2002).
- [75] Kim J.-D., Sugimura H., Takai O., “Water-repellency of a-C:H films deposited by rf plasma-enhanced CVD”, *Vacuum* **66**, 379-383 (2002).
- [76] Klages C.P., Memming R., “Microstructure and physical properties of metal-containing hydrogenated carbon films”, *Mat. Sci. Forum* **52-53**, 609-644 (1989).
- [77] Knotek O., Barimani A., “On spinodal decomposition in magnetron-sputtered (Ti,Zr) nitride and carbide thin films”, *Thin Solid Films* **174**, 51-56 (1989).
- [78] Ko H.P., Kim S., Kim J.S., Kim H.J., Yoon S.J., “Wear and dynamic properties of piezoelectric ultrasonic motor with frictional materials coated stator”, *Mat. Chem. Phys.* **90**, 391-395 (2005).
- [79] Kondrashov P.E., Smirnov I.S., Novoselova E.G., Yablokov S.Yu., Baranov A.M., Petukhov V.P., “Comparative analysis of diamond-like carbon and metal-carbon X-ray mirrors”, *Diamond Relat. Mater.* **7**, 1647-1650 (1998).
- [80] Krishna K.M., Umeno M., Nukaya Y., Soga T., Jimbo T., “Photovoltaic and spectral photoresponse characteristics of n-C/p-C solar cell on a p-silicon substrate”, *Appl. Phys. Lett.* **77**, 1472-1474 (2000).
- [81] Lacerda R.G., Stolojan V., Cox D.C., Silva S.R.P., Marques F.C., “Structural characterization of hard a-C:H films as a function of the methane pressure”, *Diamond Relat. Mater.* **11**, 980-984 (2002).
- [82] Lampe Th., Eisenberg S., Rodríguez Cabeo E., “Plasma surface engineering in the automotive industry – trends and future perspectives”, *Surf. Coat. Technol.* **174-175**, 1-7 (2003).
- [83] Langmuir I., Jones H.A., “Collisions between electrons and gas molecules”, *Phys. Rev.* **31**, 357-404 (1928).
- [84] Leezenberg P.B., Johnston W.H., Tyndall G.W., “Chemical modification of sputtered amorphous-carbon surfaces”, *J. Appl. Phys.* **89**, 3498-3507 (2001).
- [85] LiBassi A., Ferrari A.C., Stolojan V., Tanner B.K., Robertson, J., Brown L.M., “Density, sp³ content and internal layering of DLC films by X-ray reflectivity and electron energy loss spectroscopy”, *Diamond Relat. Mater.* **9**, 771-776 (2000).
- [86] Liebermann M.A., Lichtenberg A.J., *Principles of plasma discharges and materials processing* (Wiley, New Jersey, 2005).
- [87] Lifshitz Y., “Pitfalls in amorphous carbon studies”, *Diamond Relat. Mater.* **12**, 130-140 (2003).
- [88] Lifshitz Y., Kasi S.R., Rabalais J.W., Eckstein W., “Subplantation model for film growth from hyperthermal species”, *Phys. Rev. B* **41**, 10468-10480 (1990).

- [89] Lin S.H., Feldman B.J., "Amorphous hydrogenated carbon from the plasma deposition of C_2H_2 , C_2H_4 , or CH_4 ", *Philos. Mag. B* **47**, 113-116 (1983).
- [90] Liu S., Lamp D., Gangopadhyay, Sreenivas G., Ang S.S., Naseem H.A., "A new metal-to-metal antifuse with amorphous carbon", *IEEE Electron Device Lett.* **19**, 317-319 (1998).
- [91] Logothetidis S., Charitidis C., Gioti M., Panayiotatos Y., Andrea M., Kautek W., "Comprehensive study on the properties of multilayered amorphous carbon films", *Diamond Relat. Mater.* **9**, 756-760 (2000).
- [92] Logothetidis S., Stergioudis G., "Studies of density and surface roughness of ultrathin amorphous carbon films with regards to thickness with x-ray reflectometry and spectroscopic ellipsometry", *Appl. Phys. Lett.* **71**, 2463-2465 (1997).
- [93] López F., PhD Thesis "Espectroscopia de masas de iones secundarios: aportaciones a la técnica y caracterización de capas finas de a-C:H y de a-Si:H" (Universitat de Barcelona, Barcelona, 1993).
- [94] Maharizi M., Croitoru N., Seidman A., "Study of the influence of Ar on the formation of diamond-like bonds in films obtained from $CH_4 + Ar$, RF plasma deposition", *J. Non-Cryst. Solids* **289**, 221-227 (2001).
- [95] Maharizi M., Peleg D., Seidman A., Croitoru N., "Influence of substrate and film thickness on the morphology and diamond bond formation during the growth of amorphous diamond-like carbon (DLC) films", *J. Optoelectron. Adv. Mater.* **1**, 65-68 (1999).
- [96] Mantzaris N.V., Gogolides E., Boudouvis A.G., Rhallabi A., Turban G., "Surface and plasma simulation of deposition processes: CH_4 plasmas for the growth of diamondlike carbon", *J. Appl. Phys.* **79**, 3718-3729 (1996).
- [97] Martínez E., Andújar J.L., Polo M.C., Esteve J., Robertson J., Milne W.I., "Study of the mechanical properties of tetrahedral amorphous carbon films by nanoindentation and nanowear measurements", *Diamond Relat. Mater.* **10**, 145-152 (2001).
- [98] Masi M., Cavallotti C., Carrà S., "Different approaches for methane plasmas modelling", *Chem. Eng. Sci.* **53**, 3875-3886 (1998).
- [99] McKenzie D.R., "Tetrahedral bonding in amorphous carbon", *Rep. Prog. Phys.* **59**, 1611-1664 (1996).
- [100] Meng W.J., Gillispie B.A., "Mechanical properties of Ti-containing and W-containing diamond-like carbon coatings", *J. Appl. Phys.* **84**, 4314-4321 (1998).
- [101] Michler T., Grischke M., Traus I., Bewilogua K., Dimigen H., "Mechanical properties of DLC films prepared by bipolar pulsed DC PACVD", *Diamond Relat. Mater.* **7**, 1333-1337 (1998).
- [102] Miyagawa S., Nakao S., Ikeyama M., Miyagawa Y., "Deposition of diamond-like carbon films using plasma based ion implantation with bipolar pulses", *Surf. Coat. Technol.* **156**, 322-327 (2002).
- [103] Mounier E., Pauleau Y., "Effect of energetic particles on the residual stresses in nonhydrogenated amorphous carbon films deposited on grounded substrates by dc magnetron sputtering", *J. Vac. Sci. Technol. A* **14**, 2535-2543 (1996).
- [104] Münz W.-D., Lewis D.B., Hovsepian P. Eh., Schönjahn C., Ehasarian A., Smith I.J., "Industrial scale manufactured superlattice hard PVD coatings", *Surf. Eng.* **17**, 15-27 (2001).
- [105] Musil J., "Hard and superhard nanocomposite coatings", *Surf. Coat. Technol.* **125**, 322-330 (2000).
- [106] Narayan R.J., "Nanostructured diamondlike carbon thin films for medical applications", *Mat. Sci. Eng. C* **25**, 405-416 (2005).

- [107] Niederhofer A., Nesládek P., Männling H.-D., Moto K., Vepřek S., Jílek M., „Structural properties, internal stress and thermal stability of nc-TiN/a-Si₃N₄, nc-TiN/TiSi_x and nc-(Ti_{1-y}Al_ySi_x)N superhard nanocomposite coatings reaching the hardness of diamond“, *Surf. Coat. Technol.* **120-121**, 173-178 (1999).
- [108] Ogletree D.F., Carpick R.W., Salmeron M., “Calibration of frictional forces in atomic force microscopy”, *Rev. Sci. Instrum.* **67**, 3298-3306 (1996).
- [109] Ohana T., Nakamura T., Suzuki M., Tanaka A., Koga Y., “Tribological properties and characterization of DLC films deposited by pulsed bias CVD”, *Diamond Relat. Mater.* **13**, 1500-1504 (2004).
- [110] Ohring M., *The materials science of thin films* (Academic Press, San Diego, 2002).
- [111] Oliver W.C., Pharr G.M., “An improved technique for determining hardness and elastic modulus using load and displacement sensing indentation experiments”, *J. Mater. Res.* **7**, 1564-1583 (1992).
- [112] Pei Y.T., Galvan D., De Hosson J.Th.M., Cavaleiro A., “Nanostructured TiC/a-C coatings for low friction and wear resistant applications”, *Surf. Coat. Technol.* **198**, 44-50 (2005).
- [113] Peng X.L., Barber Z.H., Clyne T.W., “Surface roughness of diamond-like carbon films prepared using various techniques”, *Surf. Coat. Technol.* **138**, 23-32 (2001).
- [114] Petch N.J., “The cleavage strength of polycrystals“, *J. Iron Steel Inst.* **174**, 25-28 (1953).
- [115] Pharr G.M., Callahan D.L., McAdams S.D., Tsui T.Y., Anders S., Anders A., Ager III J.W., Brown I.G., Bhatia C.S., Silva S.R.P., Robertson J., “Hardness, elastic modulus, and structure of very hard carbon films produced by cathodic-arc deposition with substrate pulse biasing”, *Appl. Phys. Lett.* **68**, 779-781 (1996).
- [116] Piazza F., Grambole D., Schneider D., Casiraghi C., Ferrari A.C., Robertson J., „Protective diamond-like carbon coatings for future optical storage disks“, *Diamond Relat. Mater.* **14**, 994-999 (2005).
- [117] Piazza F., Grambole D., Zhou L., Talke F., Casiraghi C., Ferrari A.C., Robertson J., “Large area deposition of hydrogenated amorphous carbon films for optical storage disks”, *Diamond Relat. Mater.* **13**, 1505-1510 (2004).
- [118] Pino F.J., Bertran E., Polo M.C., Andújar J.L., “Microstructural and mechanical properties of nanometric-multilayered a-CN/a-C/.../a-CN coatings deposited by rf-magnetron sputtering and nitrogen ion-beam bombardment”, *Diamond Relat. Mater.* **10**, 952-955 (2001).
- [119] Pinyol A., Bertran E., Corbella C., Polo M.C., Andújar J.L., “Properties of W/a-C nanometric multilayers produced by RF-pulsed magnetron sputtering”, *Diamond Relat. Mater.* **11**, 1000-1004 (2002).
- [120] Polo M.C., Andújar J.L., Hart A., Robertson J., Milne W.I., “Preparation of tetrahedral amorphous carbon films by filtered cathodic vacuum arc deposition”, *Diamond Relat. Mater.* **9**, 663-667 (2000).
- [121] Precht W., Czyzniewski A., “Deposition and some properties of carbide/amorphous carbon nanocomposites for tribological application”, *Surf. Coat. Technol.* **174-175**, 979-983 (2003).
- [122] Puri S., Binder K., “Surface-directed phase separation with off-critical composition: Analytical and numerical results”, *Phys. Rev. E* **66**, 061602 (2002).
- [123] Qian L., Xiao X., “Tip in situ chemical modification and its effects on tribological measurements”, *Langmuir* **16**, 662-670 (2000).

- [124] Riccardi C., Barni R., Sindoni E., Fontanesi M., Tosi P., "Gaseous precursors of diamond-like carbon films: chemical composition of CH₄/Ar plasmas", *Vacuum* **61**, 211-215 (2001).
- [125] Ristein J., Stief R.T., Ley L., Beyer W., „A comparative analysis of a-C:H by infrared spectroscopy and mass selected thermal effusion“, *J. Appl. Phys.* **84**, 3836-3847 (1998).
- [126] Robertson J., "Amorphous carbon", *Adv. Phys.* **35**, 317-374 (1986).
- [127] Robertson J., "Diamond-like amorphous carbon", *Mater. Sci. Eng. R* **37**, 129-281 (2002).
- [128] Roberston J., "Mechanism of sp³ bond formation in the growth of diamond-like carbon", *Diamond Relat. Mater.* **14**, 942-948 (2005).
- [129] Rodil S.E., PhD. Thesis "Preparation and characterisation of carbon nitride thin films" (University of Cambridge, Cambridge, 2000).
- [130] Rosnagel S.M., "Thin film deposition with physical vapor deposition and related technologies", *J. Vac. Sci. Technol. A* **21**, S74-S87 (2003).
- [131] Rosnagel S.M., Russak M.A., Cuomo J.J., "Pressure and plasma effects on the properties of magnetron sputtered carbon films", *J. Vac. Sci. Technol. A* **5**, 2150-2153 (1987).
- [132] Roth J.R., *Industrial Plasma Engineering. Volume 1: Principles* (IOP, Bristol, 1995).
- [133] Ruan J.-A., Bhushan B., "Atomic-scale friction measurements using friction force microscopy: Part I – General principles and new measurement techniques", *Trans. Am. Soc. Mech. Eng.* **116**, 378-388 (1994).
- [134] Rusli, Yoon S.F., Huang Q.F., in: Silva S.R.P. (ed.), *Properties of Amorphous Carbon* (INSPEC, The Institution of Electrical Engineers, London, 2003).
- [135] Rusli, Yoon S.F., Huang Q.F., Ahn J., Zhang Q., Yang H., Wu Y.S., Teo E.J., Osipowicz T., Watt F., "Metal-containing amorphous carbon film development using electron cyclotron resonance CVD", *Diamond Relat. Mater.* **10**, 132-138 (2001).
- [136] Sanders D.M., Anders A., „Review of cathodic arc deposition technology at the start of the new millenium“, *Surf. Coat. Technol.* **133-134**, 78-90 (2000).
- [137] Scholl R.A., "Asymmetric bipolar pulsed power: a new power technology", *Surf. Coat. Technol.* **98**, 823-827 (1998).
- [138] Schiffmann K.I., Fryda M., Goerigk G., Lauer R., Hinze P., Bulack A., „Sizes and distances of metal clusters in Au-, Pt-, W- and Fe-containing diamond-like carbon hard coatings: a comparative study by small angle X-ray scattering, wide angle X-ray diffraction, transmission electron microscopy and scanning tunnelling microscopy“, *Thin Solid Films* **347**, 60-71 (1999).
- [139] Schiotz J., Tolla F.D.D., Jacobsen K.W., "Softening of nanocrystalline metals at very small grain sizes", *Nature* **391**, 561-563 (1998).
- [140] Schwoebel P.R., Brodie I., „Surface-science aspects of vacuum microelectronics“, *J. Vac. Sci. Technol. B* **13(4)**, 1391-1410 (1995).
- [141] Seitz F., Koehler J.S., in: Seitz F., Turnbull D. (Eds.), *Solid State Physics*, Vol. 2 (Academic Press, New York, 1956).
- [142] Sellers J., "Asymmetric bipolar pulsed DC: the enabling technology for reactive PVD", *Surf. Coat. Technol.* **98**, 1245-1250 (1998).

- [143] Sheeja D., Tay B.K., Krishnan S.M., Nung L.N., "Tribological characterization of diamond-like carbon (DLC) coatings sliding against DLC coatings", *Diamond Relat. Mater.* **12**, 1389-1395 (2003).
- [144] Shen Y.G., Mai Y.W., McBride W.E., McKenzie D.R., Zhang Q.C., "Oxygen-induced amorphous structure of tungsten thin films", *Appl. Phys. Lett.* **75**, 2211-2213 (1999).
- [145] Shen Y.G., Mai Y.W., Zhang Q.C., McKenzie D.R., McFall W.D., McBride W.E., "Residual stress, microstructure, and structure of tungsten thin films deposited by magnetron sputtering", *J. Appl. Phys.* **87**, 177-187 (2000).
- [146] Sheridan T.E., Goeckner M.J., Goree J., "Observation of two-temperature electrons in a sputtering magnetron plasma", *J. Vac. Sci. Technol. A* **9**, 688-690 (1991).
- [147] Siegal M.P., Tallant D.R., Martinez-Miranda L.J., Barbour J.C., Simpson R.L., Overmyer D.L., "Nanostructural characterization of amorphous diamondlike carbon films", *Phys. Rev. B* **61**, 10451-10462 (2000).
- [148] Silva S.R.P. in: Silva S.R.P. (ed.), *Properties of Amorphous Carbon* (INSPEC, The Institution of Electrical Engineers, London, 2003).
- [149] Spencer E.G., Schmidt P.H., Joy D.C., Sansalone F.J., "Ion-beam-deposited polycrystalline diamondlike films", *Appl. Phys. Lett.* **29**, 118-120 (1976).
- [150] Staryga E., Bağ G.W., "Relation between physical structure and electrical properties of diamond-like carbon thin films", *Diamond Relat. Mater.* **14**, 23-34 (2005).
- [151] Stoney G.G., "The tension of metallic films deposited by electrolysis", *Proc. R. Soc. London A* **82**, 172-175 (1909).
- [152] Sundararajan S., Bhushan B., "Micro/nanotribology of ultra-thin hard amorphous carbon coatings using atomic force/friction force microscopy", *Wear* **225-229**, 678-689 (1999).
- [153] Swanepoel R., "Determination of the thickness and optical constants of amorphous silicon", *J. Phys. E* **16**, 1214-1222 (1983).
- [154] Swart H.C., Jonker A.J., Claassens C.H., Chen R., Venter L.A., Ramoshebe P., Wurth E., Terblans J.J., Roos W.D., "Extracting inter-diffusion parameters of TiC from AES depth profiles", *Appl. Surf. Sci.* **205**, 231-239 (2003).
- [155] Tachibana K., Nishida M., Harima H., Urano Y., "Diagnostics and modelling of a methane plasma used in the chemical vapour deposition of amorphous carbon films", *J. Phys. D: Appl. Phys.* **17**, 1727-1742 (1984).
- [156] Tamor M.A., Vassel W.C., "Raman 'fingerprinting' of amorphous carbon films", *J. Appl. Phys.* **76**, 3823-3830 (1994).
- [157] Tsukruk V.V., Blinzyuk V.N., "Adhesive and friction forces between chemically modified silicon and silicon nitride surfaces", *Langmuir* **14**, 446-455 (1998).
- [158] Tuinstra F., Koenig J.L., "Raman spectrum of graphite", *J. Chem. Phys.* **53**, 1126-1130 (1970).
- [159] Veprek S., Veprek-Heijman M.G.J., Karvankova P., Prochazka J., "Different approaches to superhard coatings and nanocomposites", *Thin Solid Films* **476**, 1-29 (2005).
- [160] Voevodin A.A., Donley M.S., "Preparation of amorphous diamond-like carbon by pulsed laser deposition: A critical review", *Surf. Coat. Technol.* **82**, 199-213 (1996a).

- [161] Voevodin A.A., Phelps A.W., Zabinski J.S., Donley M.S., "Friction induced phase transformation of pulsed laser deposited diamond-like carbon", *Diamond Relat. Mater.* **5**, 1264-1269 (1996b).
- [162] von Keudell A., Meier M., Hopf C., „Growth mechanism of amorphous hydrogenated carbon“, *Diamond Relat. Mater.* **11**, 969-975 (2002).
- [163] Wang J.-H., Claesson P.M., Parker J.L., Yasuda H., "Dynamic contact angles and contact angle hysteresis of plasma polymers", *Langmuir* **10**, 3887-3897 (1994).
- [164] Wei Q., Narayan J., "Superhard diamondlike carbon: preparation, theory, and properties", *Inter. Mat. Rev.* **45**, 133-164 (2000).
- [165] Woods L.C., *Physics of Plasmas* (Wiley-VCH, Weinheim, 2004).
- [166] Wu W.-Y., Ting J.-M., „Self-assembled alternating nano-scaled layers of carbon and metal“, *Chem. Phys. Lett.* **388**, 312-315 (2004).
- [167] Zhang P., Tay B.K., Sun C.Q., Lau S.P., "Microstructure and mechanical properties of nanocomposite amorphous carbon films", *J. Vac. Sci. Technol. A* **20**, 1390-1394 (2002).
- [168] Zhang S., Bui X.L., Fu Y., Butler D.L., Du H., "Bias-graded deposition of diamond-like carbon for tribological applications", *Diamond Relat. Mater.* **13**, 867-871 (2004).
- [169] Zhang S., Sun D., Fu Y., Du H., "Toughening of hard nanostructural thin films: a critical review", *Surf. Coat. Technol.* **198**, 2-8 (2005).