

## Bibliography

- Abrams, G. A.; Goodman, S. L.; Nealey, P. F.; Franco, M. and Murphy, C. J. (2000). Nanoscale topography of the basement membrane underlying the corneal epithelium of the rhesus macaque, *Cell Tissue Res.*, 299, pp. 39–46.
- Amit, A. G.; Mariuzza, R. A.; Phillips, S. E. and Poljak, R. J. (1986). Three-dimensional structure of an antigen-antibody complex at 2.8 Å resolution. *Science*, 233, pp. 747–753.
- Aoyama, S.; Kurahashi, D.; Shinohara, M. and Yamashita, T. (1996). Giant microoptics: Wide applications in liquid crystal display (LCD). In *Systems, Diffractive Optics and Micro Optics* OSA Technical Digest Series, 5, pp. 266–269.
- Aoyama, S. and Yamashita, T. (1997). Planar microlens array using stamping replication method, *SPIE 3010*, pp. 11–17.
- Atay, T.; Song, J. H. and Nurmiikko, A. V. (2004). Strongly interacting plasmon nanoparticle pairs from dipole-dipole interaction to conductively coupled regime, *Nano Lett.*, 4(9), pp. 1627–1631.
- Athey, D.; Shah, D. S. H.; Phillips, S. R. and Lakey, J. H. (2005). A manufacturable surface-biology platform for nanoapplications; cell culture, analyte detection, diagnostics sensors, *Ind. Biotechnol.*, 1, pp. 185–189.
- Baek, W. H.; Seoa, I.; Yoon, T. S.; Lee, H. H.; Yun, C. M. and Kim, Y. S. (2009). Hybrid inverted bulk heterojunction solar cells with nanoimprinted TiO<sub>2</sub> nanopores, *Solar Energy Mater. Solar Cells*, 93, pp. 1587–1591.
- Barnes, W. L.; Dereux, A. and Ebbesen, T. W. (2003). Surface plasmon subwavelength optics, *Nature*, 424, pp. 824–830.
- Bernhard, C. G. (1967). Structural and functional adaptation in a visual system, *Endeavour*, 26, pp. 79–84.
- Besselink, G. A. J.; Kooyman, R. P. H.; van Os, P. J. H. J.; Engbers, G. H. M. and Schasfoort, R. B. M. (2004). Signal amplification on planar and gel-

- type sensor surfaces in surface plasmon resonance-based detection of prostate-specific antigen, *Anal. Biochem.*, 333, pp. 165–173.
- Bonroy, K.; Frederix, F.; Reekmans, G.; Dewolf, E.; Palma, R. D.; Borghs, G.; Declerck, P. and Goddeeris, B. (2006). Comparison of random and oriented immobilisation of antibody fragments on mixed self-assembled monolayers, *J. Immunol. Methods*, 312, pp. 167–181.
- Born, M. and Wolf, E. (1975). *Principles of optics* (5th edition), Pergamon Press, Oxford.
- Byun, K. M.; Kim, S. J. and Kim, D. (2006). Profile effect on the feasibility of extinction-based localized surface plasmon resonance biosensors with metallic nanowires, *Appl. Opt.*, 45(14): pp. 3382–3389.
- Chambers, D. M. and Nordin, G. P. (1999). Stratified volume diffractive optical elements as high-efficiency gratings, *J. Opt. Soc. Am. A*, 16(5), pp. 1184–1193.
- Chilwell, J. and Hodgkinson, I. (1984). Thin-films field-transfer matrix theory of planar multilayer wave guides and reflection from prism-loaded waveguides, *J. Opt. Soc. Am.*, A1(7), pp. 742–753.
- Cho, I.-H.; Paek, E.-H.; Lee, H.; Kang, J. Y.; Kim, T. S. and Paek, S. H. (2007). Site-directed biotinylation of antibodies for controlled immobilization on solid surfaces, *Anal. Biochem.*, 365, pp. 14–23.
- Choi, J.; Nordquist, K; Cherala, A; Casoose, L; Gehoski, K; Dauksher, W. J.; Sreenivasan, S. V. and Resnick, D. J. (2005). Distortion and overlay performance of UV step and repeat imprint lithography, *Microelectron. Eng.*, 78–79(1–4), pp. 633–640.
- Choi, Y. J.; Sreenivasan, S. V. and Choi, B. J. (2008). Kinematic design of large displacement precision XY positioning stage by using cross strip flexure joints and over-constrained mechanism, *Mech. Mach. Theory*, 43(6), pp. 724–737.
- Chou, S. Y.; Keimel, C. and Gu, J. (2002). Ultrafast and direct imprint of nanostructures in silicon, *Nature*, 417, pp. 835–837.
- Chou, S. Y. and Krauss, P. R. (1997). Imprint lithography with sub-10 nm feature size and high throughput, *Microelectron. Engineer.*, 35, pp. 237–240.
- Chou, S. Y.; Krauss, P. R. and Renstrom, P. J. (1995). Imprint of sub-25 nm vias and trenches in polymers, *Appl. Phys. Lett.*, 67, pp. 3114–3116.
- Chou, S. Y.; Zhuang, L. and Sun, X. (1998). Multilayer resist methods for nanoimprint lithography on nonflat surfaces, *J. Vac. Sci. Technol. B.*, 16, pp. 3922–3925.

- Chung, J. W.; Park, J. M.; Bernhardt, R. and Pyun, J. C. (2006). Immunosensor with a controlled orientation of antibodies by using neutravidin-protein a complex at immunoaffinity layer, *J. Biotechnol.*, 126, pp. 325–333.
- Colburn, M.; Bailey, T.; Choi, B. J.; Ekerdt, J. G.; Sreenivasan, S. V. and Willson, C. G. (2001). Development and advantages of step and flash imprint lithography, *Solid State Technol.*, 46(7), pp. 67–78.
- Colburn, M.; Johnson, S.; Stewart, M.; Damle, S.; Bailey, T.; Choi, B.; Wedlake, M.; Michaelson, T.; Sreenivasan, S. V.; Ekerdt, J. and Willson, C. G. (1999). Step and flash imprint lithography: A new approach to high-resolution patterning, *Proc. SPIE—Emerg. Lith. Tech.*, 3676, pp. 379–389.
- Crosson, C.; Thomas, D. and Rossi, C. (2010). Quantification of immunoglobulin G in bovine and caprine milk using a surface plasmon resonance-based immunosensor, *J. Agric. Food Chem.*, 58, pp. 3259–3264.
- Cullen, D. C.; Brown, R. G. and Lowe, C. R. (1987). Detection of immuno-complex formation via surface plasmon resonance on gold-coated diffraction gratings, *Biosensors*, 3(4), pp. 211–225.
- Curtis, A. and Wilkinson, C. (1997). Topographical control of cells, *Biomaterials*, 18, pp. 1573–1583.
- Deguchi, K.; Takeuchi, N. and Shimizu, A. (2002). Evaluation of pressure uniformity using a pressure-sensitive film and calculation of wafer distortions caused by mold press in imprint lithography, *Jpn. J. Appl. Phys.*, 41, pp. 4178–4181 (in Japanese).
- Ducre, J. J. and Zengerle, R. (2012). *Microfluidics (Microtechnology and MEMS)*, Springer-Verlag: Berlin and Heidelberg.
- Duval Malinsky, M.; Kelly, K. L.; Schatz, G. C. and Van Duyne, R. P. (2001). Nanosphere lithography: Effect of substrate on the localized surface plasmon resonance spectrum of silver nanoparticles, *J. Phys. Chem. B.*, 105(12), pp. 2343–2350.
- Ebbesen, T. W.; Lezec, H. J.; Ghaemi, H. F.; Thio, T. and Wolff, P. A. (1998). Extraordinary optical transmission through sub-wavelength hole arrays, *Nature*, 391, pp. 667–669.
- Faraday, M. (1857). The Bakerian lecture. Experimental relations of gold (and other metals) to light, *Philos. Trans.*, 147, pp. 145–181.
- Fröhlich, H. (1949). *Theory of Dielectrics*, Oxford University Press, London.
- Fujikata, J.; Ishi, T.; Makita, K.; Baba, T. and Ohashi, K. (2005). Highly enhanced speed and efficiency of Si nano-photodiode with a surface-plasmon antenna, *Int. Conf. SSDM*, E-3-3.

- Gobi, K. V.; Iwasaka, H. and Miura, N. (2007). Self-assembled PEG monolayer based SPR immunosensor for label-free detection of insulin, *Biosens. Bioelectron.*, 22, pp. 1382–1389.
- Grann, E. B.; Moharam, M. G. and Pommet, D. A. (1995). Optimal design for antireflective tapered two-dimensional subwavelength grating structures, *J. Opt. Soc. Am.*, 12(2), pp. 333–339.
- Grigalinas, V.; Tamulevicius, S.; Tomainas, R.; Kopustinskas, V.; Guobien, A. and Jucius, D. (2004). Laser pulse assisted nanoimprint lithography, *Thin Solid Films*, 453–454, pp. 13–15.
- Guo, L.; Krauss, P. R. and Chou S. Y. (1997). Nanoscale silicon field effect transistors fabricated using imprint lithography, *Appl. Phys. Lett.*, 71(13), pp. 1881–1883.
- Guo, L.; Leobandung, E.; Zhuang, L. and Chou, S. Y. (1997). Fabrication and characterization of room temperature silicon single electron memory, *J. Vac. Sci. Technol. B.*, 15, pp. 2840–2843.
- Ha, T. H.; Jung, S. O.; Lee, J. M.; Lee, K. Y.; Lee, Y.; Park, J. S. and Chung, B. H. (2007). Oriented immobilization of antibodies with GST-fused multiple Fc-specific B-domains on a gold surface, *Anal. Chem.*, 79, pp. 546–556.
- Haes, A. J.; Hall, W. P.; Chang, L.; Klein, W. L. and Van Duyne, R. P. (2004). A localized surface plasmon resonance biosensor: First steps toward an assay for Alzheimer's disease, *Nano Lett.*, 4(6), pp. 1029–1034.
- Haes, A. J. and Van Duyne, R. P. (2002). A nanoscale optical biosensor: Sensitivity and selectivity of an approach based on the localized surface plasmon resonance spectroscopy of triangular silver nanoparticles, *J. Am. Chem. Soc.*, 124 (35), pp. 10596–10604.
- Hamada, H.; Fujii, A.; Mizuguchi, Y.; Shibatani, T.; Funada, F. and Awane, K. (1995). A new high definition microlens array built in p-Si TFT-LCD panel, *Proc. Asia Display'95*, pp. 887–890.
- Hayashi, S. (2002). *Nano photonics handbook*, p. 86 (in Japanese), Asakura Press: Tokyo, Japan.
- Heidari, B.; Maximov, I. and Montelius, L. (2000). Nanoimprint lithography at the 6 in. wafer scale, *J. Vac. Sci. Technol. B.*, 18(6), pp. 3557–3560.
- Her, H. J.; Kim, J. M.; Kang, C. J. and Kim, Y. S. (2008). Hybrid photovoltaic cell with well-ordered nanoporous titania–P3HT by nanoimprinting lithography, *J. Phys. Chem. Solids.*, 69, pp. 1301–1304.
- Hoff, A. D.; Cheng, L. J.; Meyhöfer, E.; Guo, L. J. and Hunt A. J. (2004). Nanoscale protein patterning by imprint lithography, *Nano Lett.*, 4(5), pp. 853–857.

- Homola, J.; Koudela, I. and Yee S. S. (1999). Surface plasmon resonance sensors based on diffraction gratings and prism couplers: Sensitivity comparison, *Sens. Actuators B*, 54, pp. 16–24.
- Hong, E. J.; Byeon, K. J.; Park, H.; Hwang, J.; Lee, H.; Choi, K. and Jung, G. Y. (2009). Fabrication of moth-eye structure on p-GaN layer of GaN-based LEDs for improvement of light extraction, *Mater. Sci. Eng. B*, 163(3), pp. 170–173.
- Hu, W.; Yim, E. K. F.; Reano, R. M.; Leong, K. W. and Pang, S. W. (2005). Effects of nanoimprinted patterns in tissue-culture polystyrene on cell behavior, *J. Vac. Sci. Technol. B*, 23(6), pp. 2984–2989.
- Huang, L.; Reekmans, G.; Saerens, D.; Friedt, J.-M.; Frederix, F.; Francis, L.; Muyldermaans, S.; Campitelli, A. and Hoof, C. V. (2005). Prostate-specific antigen immunosensing based on mixed self-assembled monolayers, camel antibodies, and colloidal gold enhanced sandwich assays, *Biosens. Bioelectron.*, 21, pp. 483–490.
- Huang, N.-P.; Vörös, J.; De Paul, S. M.; Textor, M. and Spencer, N. D. (2002). Biotin-derivatized poly(L-lysine)-g-poly(ethylene glycol): A novel polymeric interface for bioaffinity sensing, *Langmuir*, 18, pp. 220–230.
- Ishi, T.; Fujikata, J.; Makita, K.; Baba, T. and Ohashi, K. (2005). Si nanophotodiode with a surface plasmon antenna, *Jpn. J. Appl. Phys.*, 44, pp. L364–L366 (in Japanese).
- Ishizuka-Katsura, Y.; Wazawa, T.; Ban, T.; K. Morigaki, K. and Aoyama, S. (2008). Biotin-containing phospholipid vesicle layer formed on self-assembled monolayer of a saccharide-terminated alkyl disulfide for surface plasmon resonance biosensing, *J. Biosci. Bioeng.*, 105, pp. 527–535.
- Jans, K.; Bonroy, K.; Palma, R. D.; Reekmans, G.; Jans, H.; Laureyn, W.; Smet, M.; Borghs, G. and Maes, G. (2008). Stability of mixed PEO-thiol SAMs for biosensing applications, *Langmuir*, 24, pp. 3949–3954.
- Jarem, J. M. (2002). Validation and numerical convergence of the Hankel-Bessel and Mathieu rigorous coupled wave analysis algorithms for radially and azimuthally inhomogeneous, elliptical, cylindrical systems, *Prog. Electromag. Res.*, 36, pp. 153–177.
- Jarem, J. M. and Banerjee, P. P. (1998). Rigorous coupled-wave analysis of photorefractive reflection gratings, *J. Opt. Soc. Am. B*, 15(7), pp. 2099–2106.
- Jensen, T. R.; Malinsky, M. D.; Haynes, C. L. and Van Duyne, R. P. (2000). Nanosphere lithography: Tunable localized surface plasmon resonance

- spectra of silver nanoparticles, *J. Phys. Chem. B.*, 104(45), pp. 10549–10556.
- Johnsson, B.; Löfås, S. and Lindquist, G. (1991). Immobilization of proteins to a carboxymethylatedextran-modified gold surface for biospecific interaction analysis in surface plasmon resonance sensors, *Anal. Biochem.*, 198, pp. 268–277.
- Jönsson, U.; Fägerstam, L.; Ivarsson, B.; Johnsson, B.; Karlsson, R.; Lundh, K.; Löfås, S.; Persson, B.; Roos, H.; Rönnberg, I.; Sjölander, S.; Stenberg, E.; Ståhlberg, R.; Urbaniczky, C.; Östlin, H. and Malmqvist, M. (1991). Real-time biospecific interaction analysis using surface plasmon resonance and a sensor chip technology, *Biotechniques*, 11, pp. 620–627.
- Jung, L. S.; Campbell, C. T.; Chinowsky, T. M.; Mar, M. N. and Yee, S. S. (1998). Quantitative interpretation of the response of surface plasmon resonance sensors to adsorbed films, *Langmuir*, 14(19), pp. 5636–5648.
- Jung, Y.; Lee, J. M.; Jung, H. and Chung, B. H. (2007). Self-directed and self-oriented immobilization of antibody by protein G-DNA conjugate, *Anal. Chem.*, 79, pp. 6534–6541.
- Karlsson, R.; Michaelsson, A. and Mattsson, L. (1991). Kinetic analysis of monoclonal antibody-antigen interactions with a new biosensor based analytical system, *J. Immunol. Methods*, 145, pp. 229–240.
- Katz, B. A.; Cass, R. T.; Liu, B.; Arze, R. and Collins, N. (1995). Topochemical catalysis achieved by structure-based ligand design, *J. Biol. Chem.*, 270, pp. 31210–31218.
- Kausaite-Minkstimiene, A.; Ramanaviciene, A.; Kirlyte, J. and Ramanavicius, A. (2010). Comparative study of random and oriented antibody immobilization techniques on the binding capacity of immunosensor, *Anal. Chem.*, 82, pp. 6401–6408.
- Kawaguchi, T.; Shankaran, D. R.; Kim, S. J.; Gobi, K. V.; Matsumoto, K.; Toko, K. and Miura, N. (2007). Fabrication of a novel immunosensor using functionalized self-assembled monolayer for trace level detection of TNT by surface plasmon resonance, *Talanta*, 72, pp. 554–560.
- Kelley, S. C.; Deluga, G. A. and Smyrl, W. H. (2002). Miniature fuel cells fabricated on silicon substrates, *AIChE J.*, 48(5), pp. 1071–1082.
- Kim, F.; Song, J. H. and Yang, P. (2002). Photochemical synthesis of gold nanorods, *J. Am. Chem. Soc.*, 124(48), pp. 14316–14317.
- Kim, K.; Jeong, J.; Park, S.; Choi, D.; Choi, J. and Lee, E. (2009). Development of a very large-area ultraviolet imprint lithography process, *Microelectron. Eng.*, 86(10), pp. 1983–1988.

- Kim, S.; Jung, J. M.; Choi, D. G.; Jung, H. T. and Yang, S. M. (2006). Patterned arrays of au rings for localized surface plasmon resonance, *Langmuir*, 22(17), pp. 7109–7112.
- Kim, S. J.; Gobi, K. V.; Iwasaka, H.; Tanaka, H. and Miura, N. (2007). Novel miniature SPR immunosensor equipped with all-in-one multi-microchannel sensor chip for detecting low-molecular-weight analytes, *Biosens. Bioelectron.*, 23, pp. 701–707.
- Kothare, M. V. (2006). Dynamics and control of integrated microchemical systems with application to micro-scale fuel processing, *Comp. Chem. Eng.*, 30, pp. 1725–1734.
- Krauss, P. R. and Chou, S. Y. (1995). Fabrication of planar quantum magnetic disk structure using electron beam lithography, reactive ion etching, and chemical mechanical polishing, *J. Vac. Sci. Technol. B.*, 13(6), pp. 2850–2852.
- Kretschmann, E. and Raether, H. (1968). Radiative decay of non radiative surface plasmons excited by light, *Z. Naturf.*, A23, pp. 2135–2136.
- Ku, J. and Stroeve, P. (2004). Protein diffusion in charged nanotubes: “On-off” behavior of molecular transport, *Langmuir*, 20, pp. 2030–2032.
- Kumar, A. and Whitesides, G. M. (1993). Features of gold having micrometer to centimeter dimensions can be formed through a combination of stamping with an elastomeric stamps and an alkanethiol “ink” followed by chemical etching, *Appl. Phys. Lett.*, 63, pp. 2002–2004.
- Kume, T.; Hayashi, S.; Ohkuma, H. and Yamamoto, K. (1993). Enhancement of photoelectric conversion efficiency in copper phthalocyanine solar cell by surface plasmon excitation, *Jpn. J. Appl. Phys.*, 32(8), pp. 3486–3492 (in Japanese).
- Kume, T.; Hayashi, S.; Ohkuma, H. and Yamamoto, K. (1995). Enhancement of photoelectric conversion efficiency in copper phthalocyanine solar cell: White light excitation of surface plasmon polaritons, *Jpn. J. Appl. Phys.*, 34(12A), pp. 6448–6451 (in Japanese).
- Kwon, Y.; Han, Z.; Karatan, E.; Mrksich, M. and Kay, B. K. (2004). Antibody arrays prepared by cutinase-mediated immobilization on self-assembled monolayers, *Anal. Chem.*, 76, pp. 5713–5720.
- Kyo, M.; Usui-Aoki, K. and Koga, H. (2005). Label-free detection of proteins in crude cell lysate with antibody arrays by a surface plasmon resonance imaging technique, *Anal. Chem.*, 77, pp. 7115–7121.
- Lahiri, J.; Isaacs, L.; Tien, J. and Whitesides, G. M. (1999). A strategy for the generation of surfaces presenting ligands for studies of binding based on active aster as a common reactive intermediate: A surface plasmon resonance study, *Anal. Chem.*, 71, pp. 777–790.

- Lazzarino, F.; Gourgon, C.; Schiavone, P. and Perret, C. (2004). Mold deformation in nanoimprint lithography, *J. Vac. Sci. Technol. B.*, 22(6), pp. 3318–3322.
- Le Brun, A. P.; Holt, S. A.; Shah, D. S. H.; Majkrzak, C. F. and Lakey, J. H. (2011). The structural orientation of antibody layers bound to engineered biosensor surfaces. *Biomaterials*, 32, pp. 3303–3311.
- Lee, E. S.; Jeong, J. H.; Sim, Y. S.; Kim, K. D.; Choi, D. G. and Choi, J. H. (2006). High-throughput step-and-repeat UV-nanoimprint lithography, *Curr. Appl. Phys.*, 6, pp. e92–e98.
- Lee, J. M.; Park, H. K.; Jung, Y.; Kim, J. K.; Jung, S. O. and Chung, B. H. (2007). Direct immobilization of protein G variants with various numbers of cysteine residues on a gold surface, *Anal. Chem.*, 79, pp. 2680–2687.
- Lehnert, D.; Wehrle-Haller, B.; David, C.; Weiland, U.; Ballestrem, C.; Imhof, B. A. and Bastmeyer, M. (2004). Cell behaviour on micropatterned substrata: Limits of extracellular matrix geometry for spreading and adhesion, *J. Cell Sci.*, 117, pp. 41–52.
- Lezec, H. J.; Degiron, A.; Devaux, E.; Linke, R. A.; Martin-Moreno, L.; Garcia-Vidal, F. J. and Ebbesen, T. W. (2002). Beaming light from a subwavelength aperture, *Science*, 297, pp. 820–822.
- Liedberg, B.; Nylander, C. and Lunstrom, I. (1983). Surface plasmon resonance for gas detection and biosensing, *Sens. Actuators*, 4, pp. 299–304.
- Lindquist, N. C.; Luhman, W. A.; Oh, S. H. and Holmes, R. J. (2008). Plasmonic nanocavity arrays for enhanced efficiency in organic photovoltaic cells, *Appl. Phys. Lett.*, 93(12), p. 123308.
- Lodder, J. C. (2004). Methods for preparing patterned media for high-density recording, *J. Magn. Magn. Mater.*, 272–276, pp. 1692–1697.
- Löfås, S.; Johnsson, B.; Edström, Å.; Hansson, A.; Lindquist, G.; Hillgren, R.-M. M. and Stigh, L. (1995). Methods for site controlled coupling to carboxymethyldextran surfaces in surface plasmon resonance sensors. *Biosens. Bioelectron.*, 10, pp. 813–822.
- Löfås, S. and Mcwhirter, A. (2006). The art of immobilization for SPR sensors, *Springer Ser. Chem. Sens. Biosens.*, 4, pp. 117–151.
- Lu, G. Q.; Wang, C. Y.; Yen, T. J. and Zhang, X. (2004). Development and characterization of a silicon-based micro direct methanol fuel cell, *Electrochim. Acta*, 49, pp. 821–828.
- Masson, J. -F.; Battaglia, T. M.; Khairallah, P.; Beaudoin, S. and Booksh, K. S. (2007). Quantitative measurement of cardiac markers in undiluted serum, *Anal. Chem.*, 79, pp. 612–619.

- McClelland, G. M.; Hart, M. W.; Rettner, C. T.; Best, M. E.; Carter, K. R. and Terris, B. D. (2002). Nanoscale patterning of magnetic islands by imprint lithography using a flexible mold, *Appl. Phys. Lett.*, 81, pp. 1483–1485.
- Meyers, J. P.; and Maynard, H. L. (2002). Design considerations for miniaturized PEM fuel cells, *J. Power Sources*, 109(1), pp. 76–88.
- Moore, G. E. (1965). Cramming more components onto integrated circuits, *Electronics*, 38, pp. 114–117.
- Murphy, C. J. and Jana, N. R. (2002). Controlling the aspect ratio of inorganic nanorods and nanowires, *Adv. Mater.*, 14, pp. 80–82.
- Nagatomo, K.; Kawaguchi, T.; Miura, N.; Toko, K. and Matsumoto, K. (2009). Development of a sensitive surface plasmon resonance immunosensor for detection of 2,4-dinitrotoluene with a novel oligo (ethylene glycol)-based sensor surface, *Talanta*, 79, pp. 1142–1148.
- Nath, N. and Chilkoti, A. (2004). Label-free biosensing by surface plasmon resonance of nanoparticles on glass: Optimization of nanoparticle size, *Anal. Chem.*, 76, pp. 5370–5378.
- Nilsson, C. E.; Abbas, S.; Bennemo, M.; Larsson, A.; Hämäläinen, M. D. and Frostell-Karlsson, Å. (2010). A novel assay for influenza virus quantification using surface plasmon resonance, *Vaccine*, 28, pp. 759–766.
- Nishizaki, O.; Fujioka, R. and Ito, Y. (2007). Development of D-ARS (Dustproof Anti-Reflection Structure) by using nanoimprint technology, *Omron Tech.*, 48(1), pp. 29–34.
- Nylander, C.; Liedberg, B. and Lind, T. (1982/1983). Gas detection by means of surface plasmon resonance, *Sens. Actuators*, 3, pp. 79–88.
- Odom, T. W.; Love, J. C.; Wolfe, D. B.; Paul, K. E. and Whitesides, G. M. (2002). Improved pattern transfer in soft lithography using composite stamps, *Langmuir*, 18, pp. 5314–5320.
- Odom, T. W.; Thalladi, V. R.; Love, J. C. and Whitesides, G. M. (2002). Generation of 30–50 nm structures using easily fabricated, composite PDMS masks, *J. Am. Chem. Soc.*, 124, pp. 12112–12113.
- O'Hayre, R.; Fabian, T.; Lee, S. J. and Prinz, F. B. (2003). Lateral ionic conduction in planar array fuel cells, *J. Electrochem. Soc.*, 150(4), pp. A430–A438.
- Okamoto, T.; Yamaguchi, I. and Kobayashi, T. (2000). Local plasmon sensor with gold colloid monolayers deposited upon glass substrates, *Opt Lett*, 25(6), pp. 372–374.

- Otto, A. (1968). Excitation of non-radiative surface plasma waves in silver by the method of frustrated total reflection, *Z. Phys.*, 216, pp. 398–410.
- Otto, M.; Bender, M.; Hadam, B.; Spangenberg, B. and Kurz, H. (2000). Characterization and application of a UV-based imprint technique, *Microelectron. Eng.*, 57/58, pp. 361–366.
- Park, T. J.; Hyun, M. S.; Lee, H. J.; Lee, S. Y. and Ko, S. (2009). A self-assembled fusion protein-based surface plasmon resonance biosensor for rapid diagnosis of severe acute respiratory syndrome, *Talanta*, 79, pp. 295–301.
- Pale-Grosdemange, C.; Simon, E. S.; Prime, K. L. and Whitesides, G. M. (1991). Formation of self-assembled monolayers by chemisorption of derivatives of oligo(ethylene glycol) of structure  $\text{HS}(\text{CH}_2)_{11}(\text{OCH}_2\text{CH}_2)_m\text{OH}$  on gold, *J. Am. Chem. Soc.*, 113, pp. 12–20.
- Pei, Z.; Anderson, H.; Myrskog, A.; Dunér, G.; Ingemarsson, B. and Aastrup, T. (2010). Optimizing immobilization on two-dimensional carboxyl surface: pH dependence of antibody orientation and antigen binding capacity, *Anal. Biochem.*, 398, pp. 161–168.
- Polonschii, C.; David, S.; Tombelli, S.; Mascini, M. and Gheorghiu, M. (2010). A novel low-cost and easy to develop functionalization platform. Case study: Aptamer-based detection of thrombin by surface plasmon resonance, *Talanta*, 80, pp. 2157–2164.
- Prime, K. L. and Whitesides, G. M. (1991). Self-assembled organic monolayers: Model systems for studying adsorption of proteins at surfaces, *Science*, 252, pp. 1164–1167.
- Prime, K. L. and Whitesides, G. M. (1993). Adsorption of proteins onto surfaces containing end-attached oligo(ethylene oxide): A model system using self-assembled monolayers, *J. Am. Chem. Soc.*, 115, pp. 10714–10721.
- Rechberger, W.; Hohenau, A.; Leitner, A.; Krenn, J. R.; Lamprecht, B. and Ausseneck, F. R. (2003). Optical properties of two interacting gold nanoparticles, *Opt. Comm.*, 220, pp. 137–141.
- Ross, A.; Smith, H. I.; Savas, T.; Schattenburg, M.; Farhoud, M.; Hwang, M.; Walsh, M.; Abraham, M. C. and Ram, R. J. (1999). Fabrication of patterned media for high density magnetic storage, *J. Vac. Sci. Technol. B.*, 17, pp. 3168–3176.
- Sepúlveda, B.; Angelomé, P. C.; Lechuga, L. M. and Liz-Marzán, L. M. (2009). SPR-based nanobiosensors, *Nano Today*, 4(3), pp. 244–251.
- Shah, D. S.; Thomas, M. B.; Phillips, S.; Cisneros, D. A.; Le Brun, A. P.; Holt, S. A. and Lakey, J. H. (2007). Self-assembling layers created by membrane proteins on gold, *Biochem. Soc. Trans.*, 35, pp. 522–526.

- Shi, H.; Tsai, W. B.; Garrison, M. D.; Ferrari, S. and Ratner, B. D. (1999). Template-imprinted nanostructured surfaces for protein recognition, *Nature*, 398, pp. 593–597.
- Sigal, G. B.; Bamdad, C.; Barberis, A.; Strominger, J. and Whitesides, G. M. (1996). A self-assembled monolayer for the binding and study of histidine-tagged proteins by surface plasmon resonance, *Anal. Chem.*, 68, pp. 490–497.
- Sigal, G. B.; Mrksich, M. and Whitesides, G. M. (1998). Effect of surface wettability on the adsorption of proteins and detergents, *J. Am. Chem. Soc.*, 120, pp. 3464–3473.
- Situ, C.; Wylie, A. R. G.; Douglas, A. and Elliott, C. T. (2008). Reduction of severe bovine serum associated matrix effects on carboxymethylated dextran coated biosensor surfaces, *Talanta*, 76, pp. 832–836.
- Skottrup, P.; Hearty, S.; Frøkiær, H.; Leonard, P.; Hejgaard, J.; O'Kennedy, R.; Nicolaisen, M. and Justesen, A. F. (2007). Detection of fungal spores using a generic surface plasmon resonance immunoassay, *Biosens. Bioelectron.*, 22, pp. 2724–2729.
- Sotomayor Torres, C. M.; Zankovych, S.; Seekamp, J.; Kam, A. P.; Clavijo Cedeno, C.; Hoffmann, T.; Ahopelto, J.; Reuther, F.; Pfeiffer, K.; Bleidiessel, G.; Gruetzner, G.; Maximov, M. V. and Heidari, B. (2003). Nanoimprint lithography: An alternative nanofabrication approach, *Mater. Sci. Eng.*, 23, pp. 23–31.
- Spears, D. L. and Smith, H. I. (1972). High-resolution pattern replication using soft X rays, *Electr. Lett.*, 8, pp. 102–104.
- Stapleton, S.; Bradshaw, B. and O'Kennedy, R. (2009). Development of a surface plasmon resonance-based assay for the detection of *Corynebacterium pseudotuberculosis* infection in sheep, *Anal. Chim. Acta*, 651, pp. 98–104.
- Stenberg, E.; Persson, B.; Roos, H. and Urbaniczky, C. (1991). Quantitative determination of surface concentration of protein with surface plasmon resonance using radiolabeled proteins, *J. Colloid Interface Sci.*, 143, pp. 513–526.
- Stephan, L. and Mostafa A. E. (1999). Spectral properties and relaxation dynamics of surface plasmon electronic oscillations in gold and silver nanodots and nanorods, *J. Phys. Chem. B*, 103, pp. 8410–8426.
- Tamura, T.; Nakao, M.; Ozawa, A. and Masuda, H. (1998). Direct nano-printing on Al substrate using a SiC mold, *J. Vac. Sci. Technol. B*, 16(3), pp. 1145–1149.
- Tan, H.; Gilbertson, A. and Chou, S. Y. (1998). Roller nanoimprint lithography, *J. Vac. Sci. Technol. B*, 166, pp. 3926–3928.

- Taylor, A. D.; Lucas, B. D.; Guo, L. J. and Thompson, L. T. (2007). Nanoimprinted electrodes for micro-fuel cell applications, *J. Power Sources*, 171, pp. 218–223.
- Teramura, Y. and Iwata, H. (2007). Label-free immunosensing for  $\alpha$ -fetoprotein in human plasma using surface plasmon resonance, *Anal. Biochem.*, 365, pp. 201–207.
- Terrettaz, S.; Ulrich, W. -P.; Vogel, H.; Hong, Q.; Dover, L. G. and Lakey, J. H. (2002). Stable self-assembly of a protein engineering scaffold on gold surfaces, *Protein Sci.*, 11, pp. 1917–1925.
- Terris, B. D. (2009). Fabrication challenges for patterned recording media, *J. Magn. Magn. Mater.*, 321(6), pp. 512–517.
- Thio, T.; Pellerin, K. M.; Linke, R. A.; Lezec, H. J. and Ebbesen, T. W. (2001). Enhanced light transmission through a single subwavelength aperture, *Opt. Lett.*, 26, pp. 1972–1974.
- Torrance, L.; Ziegler, A.; Pittman, H.; Paterson, M.; Toth, R. and Eggleston, I. (2006). Oriented immobilisation of engineered single-chain antibodies to develop biosensors for virus detection, *J. Vir. Methods*, 134, pp. 164–170.
- Truskett, V. N. and Watts, M. P. C. (2006). Trends in imprint lithography for biological applications, *Trends Biotechnol.*, 24(7), pp. 312–317.
- Uludağ, Y. and Tothill, I. E. (2010). Development of a sensitive detection method of cancer biomarkers in human serum (75%) using a quartz crystal microbalance sensor and nanoparticles amplification system, *Talanta*, 82, pp. 277–282.
- Usui, H.; Matsumoto, H.; Gendrin, R. and Nishikawa, T. (2001). Computer experiments on a three-wave in association with microwave power transmission in space plasma, *IEICE Trans.*, E84-B(9), pp. 2566–2573.
- Vial, S.; Pastoriza-Santos, I.; Perez-Juste, J. and Liz-Marzan, L. M. (2007). Plasmon coupling in layer-by-layer assembled gold nanorod films, *Langmuir*, 23(8), pp. 4606–4611.
- Watanabe, T.; Muranaka, N.; Iijima, I. and Hohsaka, T. (2007). Position-specific incorporation of biotinylated non-natural amino acids into a protein in a cell-free translation system, *Biochem. Biophys. Res. Commun.*, 361, pp. 794–799.
- Wazawa, T.; Ishizuka-Katsura, Y.; Nishikawa, S.; Iwane, A. H. and Aoyama, S. (2006). Grafting of poly(ethylene glycol) onto poly(acrylic acid)-coated glass for a protein-resistant surface, *Anal. Chem.*, 78, pp. 2549–2556.
- Williams, S. S.; Hampton, M. J.; Gowrishankar, V.; Ding, I. K. Templeton, J. L.; Samulski, E. T.; DeSimone, J. M. and McGehee, M. D. (2008).

- Nanostructured titania–polymer photovoltaic devices made using PFPE-based nanomolding techniques, *Chem. Mater.*, 20(16), pp. 5229–5234.
- Wood, R. W. (1902). On a remarkable case of uneven distribution of light in a diffraction grating spectrum, *Phil. Mag.*, 4, pp. 396–408.
- Wu, W.; Cui, B.; Sun, X. Y.; Zhang, W.; Zhuang, L.; Kong, L. and Chou, S. Y. (1998). Large area high density quantized magnetic disks fabricated using nanoimprint lithography, *J. Vac. Sci. Technol. B*, 16(6), pp. 3825–3829.
- Wulff, G. (1995). Molecular imprinting in cross-linked materials with the aid of molecular templates—A way towards artificial antibodies, *Angew. Chem. Int. Ed.*, 34, pp. 1812–1832.
- Xiao, P. F.; He, N. Y.; Liu, Z. C.; He, Q. G.; Sun, X. and Lu, Z. H. (2002). In situ synthesis of oligonucleotide arrays by using soft lithography, *Nanotechnology*, 13, pp. 756–762.
- Yamada, S. (2009). Latest trends. In *Plasmonic nanomaterials*, CMC Publisher: Tokyo, Japan.
- Yang, C.-Y.; Brooks, E.; Li, Y.; Denny, P.; Ho, C.-M.; Qi, F.; Shi, W.; Wolinsky, L.; Wu, B.; Wong, D. T. and Montemagno, C. D. (2005). Detection of picomolar levels of interleukin-8 in human saliva by SPR, *Lab Chip*, 5, pp. 1017–1023.
- Youn, S. W.; Ogiwara, M.; Goto, H.; Takahashi, M. and Maeda, R. (2008). Prototype development of a roller imprint system and its application to large area polymer replication for a microstructured optical device, *J. Mat. Proc. Technol.*, 202(1–3), pp. 76–85.
- Yu, Y. Y.; Chang, S. S.; Lee, C. L. and Wang, C. R. C. (1997). Gold nanorods: Electrochemical synthesis and optical properties, *J. Phys. Chem. B*, 101, pp. 6661–6664.
- Zhang, W. and Chou, S. Y. (2003). Fabrication of 60-nm transistors on 4-in. wafer using nanoimprint at all lithography levels, *Appl. Phys. Lett.*, 83, pp. 1632–1634.



# Index

- AFM *see* atomic force microscope  
AFP *see* alpha-fetoprotein  
AFP binding 104–106  
alpha-fetoprotein (AFP) 99–102, 105, 107, 109, 170, 235, 237–242, 244, 248, 264–267, 269, 271, 272, 274, 275  
Alzheimer’s disease 84  
antibodies 79, 99, 101, 102, 104, 108, 110, 152, 236, 237, 242, 251, 253, 254, 264, 265, 274  
anti-ADDL 84  
anti-ADDL IgG 84  
anti-AFP 100, 109, 188, 239–242, 264, 265, 267, 273, 275  
anti-FLAG 275  
immobilized 99, 108, 253  
immune 96  
monoclonal 253  
patterned 41  
purified 100  
single-chain 152  
antibody binding 193, 236, 237  
antibody immobilization 99, 103, 110, 254, 264  
antigen 41, 99, 110, 152, 267, 269  
antireflection structure (ARS) 35–37, 39, 40  
arrays 33, 75, 190, 193, 200, 201, 224, 230–234  
gold dot 58  
multiple 181  
nanopatterned 167  
nanosphere 75  
patterned 193  
ARS *see* antireflection structure  
atomic force microscope (AFM) 45, 46, 164, 167, 181, 182  
beam splitter 57, 58, 87, 180, 204, 205, 230  
biomolecules 44, 46, 79, 84, 113, 140, 143, 225, 249, 277  
biosensor 79, 84, 85, 113, 114, 121, 123, 127, 129, 134, 135, 139, 140, 143, 144, 161, 169, 177, 179, 218  
high-sensitive 190  
nano-imprint 235  
nanostructured 144  
palm-sized 222, 225, 230  
real-time 113  
biosensor system 203, 206, 217  
bovine serum albumin (BSA) 193, 194, 271, 272, 276  
BSA *see* bovine serum albumin  
  
cells 40, 42–44  
blood 249  
inorganic photovoltaic 47  
magnetized 30  
microfuel 49  
muscle 43  
chemicals 100, 163, 270  
mixed 270  
purified 270  
toxic 80  
colloids 70, 71, 114, 117, 161, 200, 243

- conversion efficiency 49, 89, 91, 92
- detection 81, 99, 199, 245, 246, 248, 270–275, 279  
absolute value 79  
high-sensitivity 235, 257  
quantitative 79, 80, 235  
real-time 270, 278
- detection limit 205, 238, 243, 248, 251, 252, 264, 269, 270
- detection principle 78, 81, 161
- device 1, 2, 27, 29, 83, 85, 87–89, 92, 94, 114, 161, 164, 166, 167, 178, 179, 200, 230  
charge coupled 57  
conventional 176  
innovative 16  
low-cost 83, 113  
nanopatterned 40  
nanophotonic 55  
photonic 27  
plasmonic 75  
sensing 85
- diagnosis 80, 245  
clinical 235, 238  
genetic 244  
medical 220, 247  
rapid 79
- dielectric material 55, 60, 61, 71, 78, 209
- digital video disk (DVD) 6, 53
- dispersion relation 61, 62, 156–160
- DVD *see* digital video disk
- EB *see* electron beam
- electric field 51, 52, 54, 59–61, 71, 76, 84, 91, 93, 117, 118, 121, 138, 144, 147, 148, 151, 156
- external 71, 72
- inner 71
- opposite 60
- static 121, 122
- electroforming process 19–21, 33, 44, 163, 195
- electromagnet 255–257
- electron beam (EB) 4, 5, 14, 17, 19, 58, 76, 94, 114, 161, 162, 164, 174, 176, 190, 195
- electrons 1, 20, 27, 60, 115, 116
- electroosmotic pump 207, 211
- fabrication process 7, 74, 75, 86, 93, 94, 161, 162, 172, 200  
hybrid 174  
magnetic disk 31  
multistep 177  
nanoimprint 117  
nanopattern 174  
semiconductor 86
- FBS *see* fetal bovine serum
- FET *see* field emission transistor
- fetal bovine serum (FBS) 100, 102, 105, 106, 109, 188, 194
- field emission transistor (FET) 27, 29
- film 31, 83, 117, 178, 197, 229  
adhesive 83  
pressure sensitive 179, 230  
thin 16, 93  
thin magnetic 32
- flow 201, 251, 269, 278–280  
laminar 169  
liquid 169, 255  
no-pulsating 209  
sheath 277–279  
volumic 169
- flow pump 171, 206

- flow rate 101, 170, 171, 188, 193, 206–208, 210, 213–217, 240, 246, 250, 256, 260, 264, 265, 267–269, 277
- flow sensor 207, 208, 210, 213–215
- flow system 113, 206, 214, 215, 222, 230
- free electrons 60, 61, 68, 70–72, 76, 85, 114, 115, 117, 182
- fuel cells 27, 47, 49
- glass substrate 41, 44–47, 65, 66, 75, 84, 113, 164, 167, 172, 173, 183, 185, 200
- gold colloids 116, 183, 185, 186, 200, 238–241, 243, 244, 267, 269
- streptavidin-coated 240, 241
- gold layer 66, 69, 78, 85, 86, 124–126, 154, 155, 157, 163, 164, 167, 181, 182, 186, 190, 195, 200, 269, 270
- gold substrates 96, 101, 103
- gold surface 15, 157, 159, 184, 188, 236
- grating 42, 43, 57, 58, 62, 63, 93, 157
- half-pitch 43
- optical 62, 157
- periodic 92
- imprint fluid 13
- imprint process 8, 28, 48, 86
- injection 166, 188, 189, 231, 237, 241–243, 245, 260, 278
- injection molding 6, 166, 167, 174, 175, 200, 201
- injection port 169, 277, 278
- interactions
- basic 76
- biomolecular 79, 81, 203, 204, 234
- electrostatic 103, 104
- multiple 41
- laser diodes 87, 225–227, 229
- layer 8, 14, 19, 20, 28, 35, 47, 67, 69, 75, 142, 145, 148, 149, 151, 152, 184, 186
- anti-reflection 35
- commercial 98
- conduction 163
- continuous 114
- dielectric 37
- diffusion 211
- electro-double 209
- electroformed 20, 21
- planarization 9
- sputtered 19, 20
- stacked 69
- LCD *see* liquid crystal display
- liquid crystal display (LCD) 33, 93
- lithography 4, 12, 14, 17, 52, 75
- e-beam 28
  - laser interference 30
  - multilayer 12
  - nanosphere 75, 114
- localized surface plasmon
- resonance (LSPR) 55, 60, 70–73, 75, 84, 90, 91, 113, 114, 116, 260, 276
- Lorentz–Drude model 61, 116
- LSPR *see* localized surface plasmon resonance
- LSPR
- conventional 114, 117, 129, 186
  - nanoimprint 187
- LSPR biosensors 84, 117
- LSPR modes 71, 72

- magnetic beads 248, 249, 251–265, 267–270
- magnetic fields 52, 88
- master substrate 15, 16, 18–21, 33, 36, 162–165, 174, 176
- Maxwell's equations 52, 68, 71, 115, 116
- mechanism 25, 42
- automation 82
  - basic 221
  - dipolar interaction 76
  - mechanical 81
- metal 7, 11, 55, 60, 61, 63, 65–67, 70, 71, 76, 77, 90, 93, 114–118, 123, 139, 157
- bulk 65
  - flat 61
  - heavy 4
  - multiple 10
  - noble 49
- metal colloids 71, 75, 114, 129
- metal film 66, 117
- metal layer 7, 8, 123, 269
- metal nanoparticles 75, 76, 90, 91, 117
- metal nanostructures 7, 84, 91, 114, 117
- methods
- conventional 86, 110, 200, 270, 271
  - coupling 96, 98
  - innovative 90
  - modification 248
  - photopolymerization 276
  - regeneration 276
  - sandwich 241, 244, 264, 267, 269
  - simulation 115, 140, 182, 192
  - unsophisticated 193
- microchannel 27, 81, 83, 169–179, 197, 200, 230, 231, 246, 249–251, 255, 256, 260, 261, 264, 277
- microlens array 27, 33, 35
- microlenses 33, 34
- model 118–121, 124, 135, 137, 143, 147, 150, 151, 154, 155, 225
- cheaper 225
  - dummy protein 156
  - experimental 187
  - high-end 82
  - nanopatterned 155
  - periodic 116
- mold 6–8, 10–23, 25, 26, 28, 29, 33, 34, 41, 44, 46, 86, 163–168, 172–174, 195
- elastic 15
  - fabricated 163, 166
  - hard 14
  - nanoimprint 30
  - quartz 11, 14, 23
  - roller 23
  - rolling cylinder 23
  - second-generation 21
  - thin metal film 23
  - third-generation 33
  - three-dimensional 6
  - transparent 10, 13
- mold fabrication 20, 22, 25, 163, 190
- mold patterns 8, 14, 163
- mold substrate 18, 165, 166
- mold surface 6, 20, 21, 36, 37, 45
- molecules 96, 98, 249–251, 271, 272
- antibody 103
  - disaccharide 16
  - floating 113, 190
  - floating contaminant 275
  - floating FBS 188, 189, 193
  - fluorescent 79, 245
  - myosin 44
  - plastic 197
- myosin filaments 44–46

- nanogap 114, 129, 150, 155, 181, 190
- nanogap structure 123, 124, 126, 129, 130, 134, 135, 137, 138, 155, 159, 161, 164, 177, 184
- nanoimprint biosensor 1, 113–116, 118, 122–124, 140, 144, 154, 162, 164–166, 180, 203, 235, 236, 238–242, 244–248, 280
- nanoimprint device 182, 183, 193
- nanoimprinting 6, 7, 11, 28, 32, 44
- nanoimprint lithography (NIL) 7–10, 27–31
- nanoimprint method 10, 11, 16, 19, 36, 94, 114
- nanoimprint process 8, 10, 26, 46, 200
- nanoimprint technology 1, 6, 7, 9, 11, 13, 15, 27, 29, 31, 33, 35, 37, 39–41, 43, 47
- nanoparticles 75, 76
- nanopatterns 15, 17, 41, 44, 118–120, 126, 154, 157, 161–164, 166, 167, 174, 176, 177, 181, 183, 189, 190
- nanophotonics 1, 51, 53–55, 57, 59, 95, 113, 203, 235
- nanorods 72, 74, 114, 161
- nanoscale patterns 8, 14, 17–19, 46, 166
- nanostructured surface 143, 144, 236
- nanostructures 47, 114, 119, 140, 152–154, 174
- NIL *see* nanoimprint lithography
- nonspecific adsorption 98, 99, 102, 104, 105, 108, 110
- nonspecific binding 193, 239–241, 248, 249, 259–262
- optical devices 3, 26, 33, 35, 55, 82
- optical system 52, 53, 57, 84, 194, 198, 203, 204, 206, 220–222, 224, 228–230, 255
- pattern depth 123, 129–133, 135, 150
- patterned densities 31, 32
- patterned media 27, 29, 30, 32
- pattern period 14, 35, 36, 123, 135–137, 146–148, 150, 152, 154, 159, 162, 191–195, 246
- patterns 4–6, 8, 12–15, 17, 19, 21, 25, 26, 30, 45, 46, 114, 132, 133, 135, 189–191, 193, 194, 197
- circuit 2
- concave 118
- conventional 195
- conventional groove 195
- convex 117, 118, 120
- fabricated 8, 17
- meshy 199
- meshy groove 195, 197
- microscale 14
- multiple device 163
- nanofeatured 35
- nanohybrid 22
- nanoimprint 161
- nanometer 8
- nanometer-scale 46
- nanoporous 47
- organic imprinted 13
- periodic 118
- seamless 23

- structural 115
- three-dimensional 22
- photolithography 2, 4, 5, 17, 33, 36, 53, 86, 174
  - conventional 4, 14, 27
  - optical 5
- photonic crystal 27, 33, 115
- photovoltaic device 89–91
- plunger pump 207–210, 214
- polarization filter 194, 197, 198
- polystyrene spheres 75, 76, 84, 161
- pressure 8, 11, 23, 24, 83, 178, 179, 200, 230, 256
  - high injection 166
  - optimum 8
  - uniform 23
- probe layer 144, 148, 149, 152, 153, 156, 179, 194, 235, 236, 250, 251, 264
- probe molecules 79–82, 95, 249, 251, 270
- probe proteins 79, 177, 239, 264, 267, 269
- process 7–9, 12, 14–19, 30–32, 35, 81, 83, 86, 90, 162–167, 176, 177, 234, 237, 241, 242, 279
  - antibody-binding 237
  - batch 93
  - calibration 79
  - complicated 110
  - conventional 86, 177
  - curing 10, 11
  - electroform 176
  - electroplating 36
  - lift-off 14, 18, 58
  - nanoreplication 46
  - pharmaceutical 271
  - photopolymerization 166, 167, 181, 195, 246, 259
  - sealing 178
- sputtering 117, 163, 186
- traditional 35
- wet-etch 47
- proteins 16, 40, 79, 84, 96, 99, 110, 142, 145, 214, 236, 248, 276
  - artificial 154–156
  - avidin 234
  - bioactive 41
  - dummy 155
  - fused 194
  - immobilized 103, 110
  - mutated 98
  - serum 104
- reaction 80, 108, 113, 149, 205, 224, 225, 248, 267, 268, 279
  - biomolecular 143
  - chemical 208
  - coupling 101–103, 106, 107
  - cross-coupling 103
- reaction layer 140, 141, 143, 144, 147, 169
- reactive ion etching (RIE) 6, 14, 31, 36, 86
- reflection coefficient 36, 67, 69, 125, 228, 231
- reflection dips 181, 263
- reflection intensity 224, 225, 263
- reflection spectrum 116, 124, 125, 128, 130, 138, 139, 141, 142, 145, 147–149, 151, 180–183, 191, 196–198, 204, 205, 218, 262, 263
- refractive index 65, 67, 68, 76, 77, 86, 88, 119–121, 124–127, 131, 134, 139, 140, 154, 155, 157, 182, 186, 188
- region 3, 15, 49, 55, 127, 140, 143, 144, 146, 158, 190, 191

- active 93
- gold layer 125
- hydrophobic 106
- infrared wavelength 76
- low-concentration 243, 244, 247
- macroscopic 56
- protrusion 14
- sub-micron 53
- resonance 60, 66, 70–72, 76, 93
- resonance modes 61, 76
- resonant condition 62, 71, 76, 79, 85, 147
- resonant wavelength 126–131, 134–141, 143, 144, 146, 147, 149, 150, 183, 184, 192, 196–201, 218–220, 224, 225, 257, 258, 260, 261, 263, 264, 266, 268
- RIE *see* reactive ion etching
- RIL *see* roller imprint lithography
- roller imprint lithography (RIL) 23, 24
- roller imprint system 23
- sample 57, 58, 127, 129, 136, 138, 141, 143, 150, 169, 170, 182, 184, 215, 248, 249, 260–263, 274–276
- autopsied brain 84
- contaminated 279
- experimental 245
- fabricated 86
- liquid 169, 172, 177, 209, 279
- sample flow 201, 252, 256, 262
- sample injector 204, 213, 214, 264
- sample loop 213–215
- sample material 119–121, 123, 125–127, 131, 135, 138, 140, 143, 146, 157, 180–182, 185, 186, 192, 196, 198
- sample solution 79–81, 83, 85, 188, 190, 206, 207, 213, 214, 230, 232–234, 248, 249, 251, 253, 260, 277, 278, 280
- SAMs *see* self-assembled monolayers
- scanning electron microscope (SEM) 164, 243
- self-assembled monolayers (SAMs) 15, 98, 99, 102, 106, 108–110, 245
- SEM *see* scanning electron microscope
- SEM images 17, 21, 32, 36, 48, 57, 73, 165, 177, 185, 243, 244, 260, 261
- sensing depth 140, 141, 143, 144, 146–152, 154, 161, 182, 185–188, 190, 193, 194, 236, 274
- sensing range 84, 86, 275
- sensing region 113, 141, 144, 148, 149, 151, 183, 250
- sensing spot 229, 248–250, 257, 277
- sensitivity 76, 78, 119–121, 125–128, 130, 131, 134–145, 147–149, 151–154, 156, 182, 184, 192, 197, 199, 269, 270
- average 152
- bulk 183–185
- normalized 125
- peak shift 120, 121
- sensor 77, 78, 81, 83, 85, 86, 88, 92, 102, 120, 182, 186, 198, 199, 215, 251, 277, 279, 280
- fabricated 179
- integrated 88

- sensor chip 81–83, 162, 173, 180, 181, 201, 215, 218, 219, 229, 260  
sensor device 83, 85, 161, 163–165, 167, 171–178, 180–182, 186, 194, 195, 197–200, 203, 204, 214, 230–234, 257–259, 276–279  
sensor substrate 81, 114, 121, 172, 245, 246, 251, 255, 257  
sensor surface 79–83, 95, 96, 98, 140, 141, 143, 144, 147, 148, 154–156, 180–182, 186, 188, 239, 240, 243, 249–252, 259–265, 267–270  
signal change 79, 141, 154, 156, 188, 189, 248, 257, 260, 267, 268, 270, 274–276, 278  
signal shift 155, 156, 186, 232, 233, 241, 242, 245–247, 262, 264, 267, 268, 277, 279  
signal-to-noise ratio 84, 104–106, 108, 134, 190, 193, 194, 228  
silicon substrate 7, 9, 14–16, 19, 20, 36  
silicon wafer 2, 8, 59, 162, 174, 176  
simulation 36, 115, 116, 123, 125, 126, 128, 130, 133, 137, 141–143, 145, 148–151, 154, 182–184, 186, 194  
computer 118, 154  
dynamic 115  
three-dimensional 194  
two-dimensional 118, 124, 194  
simulation models 115, 116, 118, 121, 125, 129, 132, 136–138, 140, 141, 143, 144, 147, 150, 152, 154, 155, 157–160, 182  
single nucleotide polymorphisms (SNPs) 245–247  
SNPs *see* single nucleotide polymorphisms  
solar cells 27, 47, 89  
solution 19, 21, 67, 74, 95, 100, 101, 103, 179, 186, 213, 232, 237, 250, 253, 254, 257  
acetonitrile 47  
aqueous 44, 101, 103, 107, 236  
carbon disulfide 70  
charged 209  
eigenmodal 114  
electrochemical 74  
glycerin 62  
myosin 44  
piranha 101  
post-coupling 254  
pre-coupling 254  
red-colored colloidal 70  
spectrometer 57, 65, 180, 181, 199, 205, 218, 219, 221, 222, 224, 253  
SPR *see* surface plasmon resonance  
SPR  
compact 82  
conventional 84, 143, 144, 147, 155, 156, 248, 273, 276, 277  
SPR, Kretschmann configuration 125  
SPR biosensors 79, 80, 95, 97, 98  
nanoimprint 194, 197, 270  
SPR detection 273–275  
SPR mode 61–65, 117, 160

- SPR response 98, 102, 105–107, 109  
SPR sensors 77, 78, 95, 98, 187  
structural parameters 123, 129, 140, 143, 144, 146, 149, 150, 170, 171, 190, 193, 194, 225  
substrate 8, 10–17, 23, 25, 26, 28, 29, 36, 41, 44, 45, 47, 75, 114, 118, 120, 161, 163, 164  
backlight module 26  
coated 26  
flexible 47  
multilayered 67  
plastic 46  
quartz 34  
surface plasmon 63, 66, 93  
surface plasmon resonance (SPR) 51, 52, 60–70, 80–82, 88, 90–96, 102, 109, 110, 113, 144, 145, 196, 197, 203, 235, 267, 274, 275  
target molecules 41, 79, 80, 95, 96, 98, 144, 149, 152, 153, 169, 188, 248–251, 253, 257, 270, 271, 273, 278, 279  
target proteins 156, 238, 252  
target sample 57, 223, 270, 271  
target sensitivity 152–154  
TIR *see* total internal reflection  
TMM *see* transfer matrix method  
TNF *see* tumor necrosis factor  
total internal reflection (TIR) 44, 62–65, 81, 113, 125, 141, 157, 186, 203  
transfer matrix method (TMM) 67, 70, 88  
transistor 2, 8, 27, 29  
field emission 27  
thin film 33  
tumor necrosis factor (TNF) 245  
  
UV absorption 271, 272, 274, 275  
UV curable polymer 10, 11, 34, 36, 164  
UV exposure 11, 13, 25  
UV nanoimprint 10, 15  
  
wavelength 2–5, 35, 36, 53, 54, 60, 61, 65, 70, 71, 73, 74, 123–125, 130, 155, 183, 191, 196, 199, 262, 263  
incident 54  
peak 120, 121, 201, 225, 259  
wavelength shift 143, 155, 185, 187, 193, 225  
wave number 61–64, 157

