

REFERENCES

- [1] (anon.), "The Royal Society's Soirée," *Nature*, vol. 3, pp. 395–396, 1871.
- [2] G. Abbruzzese, "Computer simulated grain growth stagnation," *Acta. Met.*, vol. 33, pp. 1329–1337, 1985.
- [3] G. Abbruzzese, "Computer simulated stagnation and abnormal grain growth," in *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society: Warrendale, 1986), pp. 61–76.
- [4] G. Abbruzzese and K. Lüke, "A theory of texture controlled grain growth—I. Derivation and general discussion of the model," *Acta. Met.*, vol. 34, pp. 905–914, 1986.
- [5] G. Abbruzzese and K. Lüke, "A statistical theory of grain growth including texture and drag effects and its application to texture controlled grain growth," *Annealing Processes— Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 1–14.

- [6] D. A. Aboav, "The Arrangement of Grains in a Polycrystal," *Metallography*, vol. 3, pp. 383-390, 1970.
- [7] D. A. Aboav, "The Stability of Grains in a Polycrystal," *Metallography*, vol. 4, pp. 425-441, 1971.
- [8] D. A. Aboav, "The Arrangement of Cells in a Net," *Metallography*, vol. 13, pp. 43-58, 1980.
- [9] D. A. Aboav and T. G. Langdon, "The Shape of Grains in a Polycrystal," *Metallography*, vol. 2, pp. 171-178, 1969.
- [10] R. M. C. de Almeida and J. R. Iglesias, "Towards Statistical Mechanics of a 2-D Random Cellular Structure," *J. Phys. A*, vol. 21, pp. 3365-3371, 1988.
- [11] R. M. C. de Almeida and J. R. Iglesias, "Equilibrium States of 2d Cellular Structures," (preprint) 1988.
- [12] M. P. Anderson, "Simulation of grain growth in two and three dimensions," *Annealing Processes- Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Lefers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 15-34.

- [13] M. P. Anderson, G. S. Grest, and D. J. Srolovitz, "Grain Growth in three dimensions: A lattice model," *Scripta. Met.*, vol. 19, pp. 225-230, 1985.
- [14] M. P. Anderson, G. S. Grest, and D. J. Srolovitz, "The microstructural dynamics of primary and secondary recrystallization," in *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society: Warrendale, 1986), pp. 77-93.
- [15] M. P. Anderson, G. S. Grest, and D. J. Srolovitz, "Computer simulation of normal grain growth in three dimensions," *Philos. Mag.*, vol. B 59, pp. 293-329, 1989.
- [16] M. P. Anderson, D. J. Srolovitz, G. S. Grest, and P. S. Sahni, "Computer simulation of grain growth-I. Kinetics," *Acta. Met.*, vol. 32, pp. 783-791, 1984.
- [17] E. N. da C. Andrade and D. A. Aboav, "Grain growth in metals of close-packed hexagonal structure," *Proc. Roy. Soc. London*, vol. 291A, pp. 18-40, 1966.
- [18] A. S. Argon and L. T. Shi, "Analysis of plastic flow in an amorphous soap bubble raft by the use of an inter-bubble potential," *Philos. Mag.*, vol. A 46, pp. 275-294, 1982.

- [19] M. F. Ashby and R. A. Verrall, "Diffusion-accommodated flow and superplasticity," *Acta. Met.*, vol. 21, pp. 149–163, 1973.
- [20] H. V. Atkinson, "Theories of Normal Grain Growth in Pure Single Phase Systems," *Acta. Met.*, vol. 36, pp. 469–491, 1988.
- [21] J. H. Aubert, A. M. Kraynik, P. B. Rand, "Aqueous Foams," *Sci. Am.*, vol. 254 May, pp. 74–82, 1986.
- [22] K. L. Babcock and R. M. Westervelt, "Elements of Cellular Domain patterns in Magnetic Garnet Films," (preprint) 1989. In which the authors shamelessly steal results from U. of C. without so much as an acknowledgement.
- [23] B. Bay and N. Hansen, "Deformed and recovered microstructures in pure aluminum," *Annealing Processes— Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 215–220.
- [24] P. A. Beck, "Annealing of Cold Worked Metals," *Advances in Phys.*, vol. 3, pp. 245–324, 1954.
- [25] C. W. J. Beenakker, "Evolution of Two-Dimensional Soap-Film Networks," *Phys. Rev. Lett.*, vol. 57, pp. 2454–2457, 1986.

- [26] C. W. J. Beenakker, "Two-Dimensional Soap Froths and polycrystalline networks: Why are large cells many-sided?," *Physica*, vol. 147A, pp. 256–267, 1987.
- [27] C. W. J. Beenakker, "Numerical Simulation of Grain Growth in a Two-Dimensional Network," (preprint) 1988.
- [28] C. W. J. Beenakker, "Evolution of Two-Dimensional Soap-Film Networks," *Phys. Rev. A*, vol. 37, pp. 1697–1704, 1988.
- [29] B. Berge, private communication.
- [30] M. Blanc and A. Mocellin, "Grain coordination in plane sections of polycrystals," *Acta. Met.*, vol. 27, pp. 1231–1237, 1979.
- [31] A. H. Bobeck, "Properties and Device Applications of Magnetic Domains in Orthoferrites," *Bell Tech. J.*, vol. 46, pp. 1901–1925, 1967.
- [32] G. F. Bolling and W. C. Winegard, "Grain growth in zone-refined lead," *Acta. Met.*, vol. 6, pp. 283–287, 1958.

- [33] G. F. Bolling and W. C. Winegard, "Some effects of impurities on grain growth in zone-refined lead," *Acta. Met.*, vol. 6, pp. 288–292, 1958.
- [34] B. N. Boots, "The Arrangements of Cells in "Random" Networks," *Metallography*, vol. 15, pp. 53–62, 1982.
- [35] R. Boyle, *New Experiments, Physico-Mechanical, Touching the Spring of Air* (Oxford: Oxford, 1660).
- [36] C. V. Boys, *Soap Bubbles: Their Colours and the Forces which Mold Them*, (Dover Press: New York, 1959). Reissue of 1911 edition.
- [37] Sir Lawrence Bragg, "A Model illustrating Intercrystalline Boundaries and Plastic Flow in Metals," *J. Sci. Instr.*, vol. 19, pp. 148–150, 1942.
- [38] Sir Lawrence Bragg and J. F. Nye, "A dynamical model of crystal structure," *Proc. Roy. Soc. London*, vol. A 190, pp. 474–481, 1947.
- [39] R. J. Brook, "Controlled Grain Growth," in *Ceramic Fabrication Processes, Treaties on Materials Science and Technology*, vol. 9, F. F. Y. Wang, ed. (Academic Press: New York, 1976), pp. 331–364.
- [40] Sir. R. Bulkley, "Concerning the Giant's Causeway, . . ." *Phil. Trans. Roy. Soc. London*, vol. 17, pp. 708–711, 1693.

- [41] H. J. Bunge and E. Dahlem, "Texture changes and growth anomalies during continuous grain growth," *Annealing Processes- Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 255-260.
- [42] J. E. Burke and D. Turnbull, "Recrystallization and grain growth," *Prog. Met. Phys.*, vol. 3, pp. 220-292, 1952.
- [43] J. W. Cahn "On Hillert's grain growth catalyst," *Acta. Met.*, vol. 13, pp. 1091-1092, 1965.
- [44] R. W. Cahn, "Topology of crystal grains," *Nature*, vol. 250, pp. 702-703, 1974.
- [45] J. A. Cape and G. W. Lehman, "Magnetic Domain Structures in Thin Uniaxial Plates with Perpendicular Easy Axis," *J. Appl. Phys.*, vol. 43, pp. 5732-5756, 1971.
- [46] E. Carnal and A. Mocellin, "A topological model for plane sections of polycrystals," *Acta. Met.*, vol. 29, pp. 135-143, 1981.
- [47] E. A. Ceppi and O. B. Nasello, "Computer simulation of bidimensional grain growth," *Scripta. Met.*, vol. 18, pp. 1221-1225, 1984.

- [48] E. A. Ceppi and O. B. Nasello, "Computer Simulation of grain boundary migration (I): The algorithm," in *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society: Warrendale, 1986), pp. 1-11.
- [49] C. H. Chen, J. C. Phillips, K. L. Tai, and P. M. Bridenbaugh, "Domain microscopy in chalcogenide alloy glass thin films," *Sol. State Comm.*, vol. 38, pp. 657-661, 1981.
- [50] R. Collins and A. Wragg, "Maximum Entropy Histograms," *J. Phys. A*, vol. 10, pp. 1441-1464, 1977.
- [51] H. S. M. Coxeter, *Introduction to Geometry* (John Wiley and Sons: New York, 1969).
- [52] I. K. Crain, "The Monte-Carlo Generation of Random Polygons," *Comp. and Geosci.*, vol. 4, pp. 131-141, 1978.
- [53] J. Cwajna, A. Maciejny, and M. Malinski, "Stereological criteria of grain size homogeneity," *Annealing Processes- Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 273-278.
- [54] C. H. Desch, "The Solidification of Metals from the Liquid State," *J. Inst. Metals*, vol. 22, pp. 241-263, 1919.

- [55] M. Desmarest, "Mémoire Sur l'origine & la nature du Basalte á grandes colonnes polygones, déterminées par l'Histoire Naturelle de cette pierre. Observée en Auvergne," *Mem. Acad. Roy. Sci. (Paris)*, vol. 87, pp. 705-774, 1771.
- [56] J. Dewar, "Soap Bubbles of Long Duration," *Proc. Roy. Inst. Gt. Brit.*, vol. 22, pp. 179-185, 1917.
- [57] J. Dewar, "Soap Films as Detectors: Stream Lines and Sound," *Proc. Roy. Inst. (London)*, vol. 24, pp. 197-204, 1923.
- [58] R. D. Doherty, "Discussion of Mechanism of Steady-State Grain Growth in Aluminum," *Met. Trans.*, vol. 6A, pp. 588-589, 1975.
- [59] J. P. Drolet and A. Galbois, "The impurity-drag effect on grain growth," *Acta. Met.*, vol. 16, pp. 1387-1399, 1968.
- [60] W. F. Druyvesteyn and J. W. F. Dorleijn, "Calculations on some periodic magnetic domain structures; Consequences for bubble devices," *Philips Res. Repts.*, vol. 26, pp. 11-28, 1971.

- [61] H. Eichelkraut, K. Lücke, G. Abbruzzese, "Texture controlled grain growth in Cu-Zn and Al-Mg alloys," *Annealing Processes- Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 303-308.
- [62] Y. Enomoto, K. Kawasaki, and T. Nagai, "Two-Dimensional Vertex Model with Local Friction Coefficient," *Int. J. of Mod. Phys.*, vol. B 3, pp. 163-169, 1989.
- [63] A. H. Eschenfelder, *Magnetic Bubble Technology* (Springer Verlag: Berlin, 1980).
- [64] F. Feltham, "Grain growth in metals," *Acta. Met.*, vol. 5, pp. 97-105, 1957.
- [65] Samuel Foley, "An Account of the Giants Causway in the North of Ireland," *Phil. Trans. Roy. Soc. London*, vol. 18, pp. 169-182, 1694.
- [66] E. Fukushima and A. Ookawa, "The Transition Structure of the Grain Boundary observed in Soap Bubble Raft," *J. Phys. Soc. Japan.*, vol. 8, pp. 129-130, 1953.

- [67] E. Fukushima and A. Ookawa, "On the Dynamical Behaviour of the Grain Boundary in Soap Bubble Raft under Shear Stress," *J. Phys. Soc. Japan.*, vol. 8, pp. 280–282, 1953.
- [68] E. Fukushima and A. Ookawa, "Observation of the Grain Boundary in Soap Bubble Raft Part I. Static Feature of the Grain Boundary," *J. Phys. Soc. Japan.*, vol. 8, pp. 609–614, 1953.
- [69] E. Fukushima and A. Ookawa, "Observation of the Grain Boundary in Soap Bubble Raft Part II. Dynamical behaviour of the Grain Boundary," *J. Phys. Soc. Japan.*, vol. 9, pp. 44–51, 1954.
- [70] E. Fukushima and A. Ookawa, "Some Characters of the Soap Bubble Raft in a Vibrating State," *J. Phys. Soc. Japan.*, vol. 10, pp. 970–981, 1955.
- [71] E. Fukushima and A. Ookawa, "Observation of the Grain Boundary in Soap Bubble Raft Part III. The Grain Boundary in Vibrating State," *J. Phys. Soc. Japan.*, vol. 10, pp. 139–146, 1957.
- [72] M. A. Fortes and A. C. Ferro, "Trivalent polyhedra: Properties, representation and enumeration," *Acta. Met.*, vol. 33, pp. 1683–1696, 1985.

- [73] M. A. Fortes and A. C. Ferro, "Topology and transformation in cellular structures," *Acta. Met.*, vol. 33, pp. 1697-1708, 1985.
- [74] V. E. Fradkov, "A theoretical investigation of two-dimensional grain growth in the 'gas' approximation," (preprint) 1988.
- [75] V. E. Fradkov, A. S. Kravchenko, and L. S. Shvindlerman, "Experimental investigation of normal grain growth in terms of area and topological class," *Scripta. Met.*, vol. 19, pp. 1291-1296, 1985.
- [76] V. E. Fradkov, L. S. Shvindlerman, and D. G. Udler, "Computer simulation of grain growth in two dimensions," *Scripta. Met.*, vol. 19, pp. 1285-1290, 1985.
- [77] V. E. Fradkov, L. S. Shvindlerman, and D. G. Udler, "Short-range order in the arrangement of grains in two-dimensional polycrystals," *Philos. Mag. Letters*, vol. 55, pp. 289-294, 1987.
- [78] V. E. Fradkov, D. G. Udler, and R. E. Kris, "Computer simulation of two-dimensional normal grain growth (the 'gas' approximation)," *Philos. Mag. Letters*, vol. 58, pp. 670-674, 1988.

- [79] H. J. Frost and C. V. Thompson, "Microstructural Evolution in thin films," in *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society, Warrendale: 1986), pp. 33-47.
- [80] H. J. Frost and C. V. Thompson, "The Effect of Nucleation Conditions on the Topology and Geometry of Two-Dimensional Grain Structures," *Acta. Met.*, vol. 35, pp. 529-540, 1987.
- [81] H. J. Frost and C. V. Thompson, "Development of Microstructure in Thin Films," *S.P.I.E.*, vol. 821, pp. 77-87, 1987.
- [82] H. J. Frost and C. V. Thompson, "Computer Simulation of Microstructural Evolution in Thin Films," (preprint) 1988.
- [83] H. J. Frost, C. V. Thompson, C. L. Howe, and J. Whang, "A two-dimensional computer simulation of capillarity-driven grain growth: Preliminary results," *Scripta. Met.*, vol. 22, pp. 65-70, 1988.
- [84] H. J. Frost, J. Whang, and C. V. Thompson, "Modeling of grain growth in thin films," *Annealing Processes- Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 315-320.

- [85] Fu Tingliang, "A Study of Two-Dimensional Soap Froths," unpublished M.S. thesis, Trinity College, Dublin, 1986.
- [86] R. L. Fullman, "Boundary Migration During Grain Growth," in *Metal Interfaces*, (American Society for Metals, Cleveland, 1952), pp. 179–207.
- [87] M. Gardner, "Mathematical Games," *Sci. Am.*, vol. 254 June, pp. 16–23, 1986.
- [88] L. Gaultier, "Mémoire Sur les Moyens généraux de construire graphiquement un Cercle déterminé par trois conditions, et une Sphère déterminée par quatre conditions," *Journal de l'Ecole Polytechnique*, vol. 16, pp. 124–214, 1813.
- [89] A. Getis and B. Boots, *Models of Spatial Processes: An Approach to the Study of Point, Line and Area Patterns* (Cambridge University Press, Cambridge: 1978).
- [90] E. N. Gilbert, "Random Subdivisions of Space into Crystals," *Ann. Math. Stat.*, vol. 33, pp. 958–972, 1962.
- [91] Gladstone, "Notes on Froth," *Philos. Mag.*, vol. 14, pp. 314–315, 1857.
- [92] J. A. Glazier, from data supplied by B. Berge.

- [93] J. A. Glazier, M. P. Anderson, G. S. Grest and J. Stavans, "The Two Dimensional Soap Froth and the Q-state Potts Model: A detailed Comparison," (preprint) 1989.
- [94] J. A. Glazier, S. P. Gross, and J. Stavans, "Dynamics of two-dimensional soap froths," *Phys. Rev. A*, vol. 36, pp. 306–312, 1987.
- [95] J. A. Glazier, and J. Stavans, unpublished.
- [96] M. E. Glicksman and S. P. Marsh, "Microstructural coarsening in 2- and 3-dimensions—Applications of multiparticle diffusion algorithms," in *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society: Warrendale, 1986), pp. 109–124.
- [97] J. Gollub, private communication.
- [98] W. C. Graustein, "On the Average Number of Sides of Polygons of a Net," *Ann. of Math.*, vol. 32, pp. 149–153, 1931.
- [99] G. S. Grest, M. P. Anderson, and D. J. Srolovitz, "Computer simulation of microstructural dynamics," in *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society: Warrendale, 1986), pp. 21–32.
- [100] G. S. Grest, D. J. Srolovitz, and M. P. Anderson, "Computer simulation of grain growth—IV. Anisotropic grain boundary energies," *Acta. Met.*, vol. 33, pp. 509–520, 1985.

- [101] G. S. Grest, D. J. Srolovitz, and M. P. Anderson, "Domain-growth kinetics for the Q -state Potts model in two and three dimensions," *Phys. Rev. B*, vol. 38, pp. 4752–4760, 1988.
- [102] E. A. Grey and G. T. Higgins, "A velocity independent drag during grain boundary migration," *Scripta. Met.*, vol. 6, pp. 253–258, 1972.
- [103] E. A. Grey and G. T. Higgins, "Solute limited grain boundary migration: A rationalization of grain growth," *Acta. Met.*, vol. 21, pp. 309–321, 1973.
- [104] E. Guazzelli, "Deux Etudes Experimentales du Desordre en Hydrodynamique Physique," Unpublished Doctoral Thesis, L'Universite de Provence (1986), pp. 193–195.
- [105] M. Hasegawa and M. Tanemura, "On the Pattern of Space division by territories," *Ann. Inst. Statist. Math.*, vol. 28, pp. 509–519, 1976.
- [106] M. Hillert, "On the theory of normal and abnormal grain growth," *Acta. Met.*, vol. 13, pp. 227–238, 1965.

- [107] E. L. Holmes and W. C. Winegard, "Grain growth in zone-refined tin," *Acta. Met.*, vol. 7, pp. 411–414, 1959.
- [108] R. Hooke, *Micrographia*, (London: 1665).
- [109] C. L. Howe, *Computer Simulation of Grain growth in two Dimensions*, unpublished M.E. thesis, Dartmouth College, 1987.
- [110] H. Hsu and B. B. Rath, "On the Time Exponent in Isothermal Grain Growth," *Met. Trans.*, vol. 1, pp. 3181–3184, 1970.
- [111] O. Hunderi, "Steady state grain growth: A note on the kinetics," *Acta. Met.*, vol. 27, pp. 167–169, 1979.
- [112] O. Hunderi, N. Ryum, and H. Westengen, "Computer simulation of grain growth," *Acta. Met.*, vol. 27, pp. 161–165, 1979.
- [113] O. Hunderi and N. Ryum, "The kinetics of normal grain growth," *J. Mater. Sci.*, vol. 15, pp. 1104–1108, 1980.
- [114] O. Hunderi and N. Ryum, "Computer simulation of stagnation in grain growth," *Acta. Met.*, vol. 29, pp. 1737–1745, 1981.
- [115] E. T. Jaynes, "Information Theory and Statistical Mechanics," *Phys. Rev.*, vol. 106, pp. 620–630, 1957.

- [116] E. T. Jaynes, "Information Theory and Statistical Mechanics. II," *Phys. Rev.*, vol. 108, pp. 171–190, 1957.
- [117] K. Kawasaki and Y. Enomoto, "Statistical Theory of Ostwald ripening with elastic field interaction," *Physica*, vol. A 150, pp. 462–498, 1988.
- [118] K. Kawasaki, T. Nagai, and K. Nakashima, "Vertex Models of Two-Dimensional Grain Growth," (preprint) 1988.
- [119] K. Kawasaki, T. Nagai, and K. Nakashima, "Statistical Physics of Domain Walls and Grain Boundaries in Ordering Kinetics," (preprint) 1988.
- [120] Lord Kelvin, "On the Division of Space with Minimum Partitional Area," *Philos. Mag.*, vol. 24, pp. 503–515, 1887.
- [121] R. Kikuchi, "Shape Distribution of Two Dimensional Soap Froths," *J. Chem. Phys.*, vol. 24, pp. 861–867, 1956.
- [122] H. O. K. Kirchner, "Coarsening of Grain-Boundary Precipitates," *Met. Trans.*, vol. 2, pp. 2861–2864, 1971.

- [123] G. Konig and W. Blum, "Comparison Between the Cell Structures Produced in Aluminum by Cycling and by Monotonic Creep," *Acta. Met.*, vol. 28, pp. 519–537, 1980.
- [124] C. Kooy and U. Enz, "Experimental and theoretical study of the domain configuration in thin layers of $\text{BaFe}_{12}\text{O}_{19}$," *Philips Res. Repts.*, vol. 15, pp. 7–29, 1960.
- [125] A. M. Kraynik, "Foam Rheology: The Linear Viscoelastic Responses of a Spatially Periodic Model," (preprint) 1987.
- [126] A. M. Kraynik, "Foam Flows," *Ann. Rev. Fluid. Mech.*, vol. 20, pp. 325–357, 1988.
- [127] A. M. Kraynik, Movie available from A. M. Kraynik, Fluid and Thermal Sciences Department 1510, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM 87185.
- [128] W. B. Krantz, K. J. Gleason, and N. Caine, "Patterned Ground," *Sci. Am.*, vol. 259 December, pp. 68–76, 1988.
- [129] A. M. Kraynik and M. G. Hansen, "Foam and Emulsion Rheology: A Quasistatic Model for Large Deformations of Spatially-Periodic Cells," *J. Rheology*, vol. 30, pp. 409–439, 1986.
- [130] A. M. Kraynik and M. G. Hansen, "Foam Rheology: A Model of Viscous Phenomena," (preprint) 1987.

- [131] A. I. Kreines and V. E. Fradkov, "Automatizirsvannie Analiz Iotcheis-
tech Struktur," *Experimental Problems and Techniques*, vol. 5, pp.
62-64, 1986.
- [132] S. K. Kurtz and F. M. A. Carpay, "Microstructure and normal grain
growth in metals and ceramics. Part I. Theory," *J. Appl. Phys.*,
vol. 51, pp. 5725-5744, 1980.
- [133] S. K. Kurtz and F. M. A. Carpay, "Microstructure and normal grain
growth in metals and ceramics. Part II. Experiment," *J. Appl.
Phys.*, vol. 51, pp. 5745-5754, 1980.
- [134] C. J. Lambert and D. Weaire, "Theory of the Arrangement of Cells
in a Network," *Metallography*, vol. 14, pp. 307-318, 1981.
- [135] C. J. Lambert and D. Weaire, "Order and disorder in two-dimensional
random networks," *Philos. Mag.*, vol. B 47, pp. 445-450, 1983.
- [136] J. S. Langer, "Pattern formation during crystal growth: Theory,"
in *Nonlinear Phenomena at Phase Transitions and Instabilities*, T.
Riste, ed. (New York: Plenum Press, 1981), pp. 309-336.

- [137] C. Lantuejoul, "Computation of the histograms of the number of edges and neighbours of cells in a tessellation," in *Geometrical Probability and Biological Structures: Buffon's 200th Anniversary*, R. E. Miles and J. Serra, eds. (Springer-Verlag: Berlin, 1978), pp. 323–329.
- [138] A. van Leeuwenhoek, "On the Formation of Rushes," in *Arcana Naturae*, Epistola 74, 1692.
- [139] R. D. Levine and M. Tribus, *The Maximum Entropy Formalism* (M.I.T. Press: Cambridge, 1979).
- [140] F. T. Lewis, "A further study of the polyhedral shapes of cells," *Proc. A.A.A.S.*, vol. 61, pp. 1–34, 1925.
- [141] F. T. Lewis, "The correlation between cell division and the shapes and sizes of prismatic cells in the epidermis of cucumis," *Anat. Rec.*, vol. 38, pp. 341–362, 1928.
- [142] F. T. Lewis, "A comparison between the mosaic of polygons in a film of artificial emulsion and the pattern of simple epithelium in surface view (cucumber epidermis and human amnion)," *Anat. Rec.*, vol. 50, pp. 235–265, 1931.

- [143] F. T. Lewis, "Mathematically precise features of epithelial mosaics: observations on the endothelium of capillaries," *Anat. Rec.*, vol. 55, pp. 323-341, 1928.
- [144] F. T. Lewis, "A geometric accounting for diverse shapes of 14-hedral cells: the transition from dodecahedra to tetrakaidekahedra," *Am. J. Bot.*, vol. 30, pp. 74-81, 1943.
- [145] F. T. Lewis, "The geometry of growth and cell division in columnar parenchyma," *Am. J. Bot.*, vol. 31, pp. 619-629, 1944.
- [146] F. T. Lewis, "The geometry of growth and cell division in epithelial mosaics," *Am. J. Bot.*, vol. 30, pp. 766-776, 1944.
- [147] F. T. Lewis, "The Analogous Shapes of Cells and Bubbles," *Proc. A.A.A.S.*, vol. 77, pp. 147-186, 1948.
- [148] I. M. Lifschitz and V. V. Slezov, "Kinetics of diffusive decomposition of supersaturated solid solutions," *Soviet J.E.T.P.*, vol. 35, pp. 331-339, 1959.
- [149] I. M. Lifschitz and V. V. Slyozov, "The kinetics of precipitation from supersaturated solid solutions," *J. Phys. Chem. Solids*, vol. 19, pp. 35-50, 1961.

- [150] M. Lösche and H. Möhwald, "Fluorescence microscope to observe dynamical processes in monomolecular layers at the air/water interface," *Rev. Sci. Instrum.*, vol. 55, pp. 1968–1972, 1984.
- [151] H. W. Lotwick, "Simulation of Some Spatial Hard Core Models, and the Complete Packing Problem," *J. Statist. Comput. Simul.*, vol. 15, pp. 295–314, 1982.
- [152] N. P. Louat, "On the Theory of Normal Grain Growth," *Acta Met.*, vol. 22, pp. 721–724, 1974.
- [153] J. Maddox, "Soap bubbles make serious physics," *Nature*, vol. 338, pp. 293–293, 1989.
- [154] M. Magnasco, private communication, 1989.
- [155] R. Mallet, "On the Origin and Mechanism of production of the Prismatic (or columnar) Structure of Basalt," *Philos. Mag.*, vol. 50, pp. 122–135, and 201–227, 1875.
- [156] A. P. Malozemoff and J. C. Slonczewski, *Magnetic Domain Walls in Bubble Materials* (Academic Press: New York, 1979).
- [157] M. Marder, "Soap-bubble growth," *Phys. Rev. A*, vol. 36, pp. 438–440, 1987.

- [158] J. W. Marvin, "The Shape of Compressed Lead Shot and Its Relation to Cell Shape," *Am. J. Bot.*, vol. , pp. 280-288, 1939.
- [159] J. W. Martin and R. D. Doherty, *Stability of Microstructure in Metallic Systems* (Cambridge University Press: Cambridge, 1976), pp. 221-244.
- [160] E. B. Matzke, "Volume-shape relationships in lead shot and their bearing on cell shapes," *Am. J. Bot.*, vol. 26, pp. 288-293, 1939.
- [161] E. B. Matzke, "The three dimensional shape of bubbles in foam—an analysis of the rôle of surface forces in three dimensional cell shape determination," *Am. J. Bot.*, vol. 33, pp. 58-80, 1946.
- [162] E. B. Matzke and J. Nestler, "Volume-shape relationships in variant foams. A further study of the rôle of surface forces in three dimensional cell shape determination," *Am. J. Bot.*, vol. 33, pp. 130-144, 1946.
- [163] H. M. McConnell, L. K. Tamm, and R. M. Weis, "Periodic structures in lipid monolayer phase transitions," *Proc. Natl. Acad. Sci. USA*, vol. 81, pp. 3249-3253, 1984.
- [164] J. L. Meijering, "Interface area, edge length, and number of vertices in crystal aggregates with random nucleation," *Philips Res. Repts.*, vol. 8, pp. 270-290, 1953.

- [165] R. Messier and R. C. Ross, "Evolution of microstructure in amorphous hydrogenated silicon," *J. Appl. Phys.*, vol. 53, pp. 6220–6225, 1982.
- [166] R. E. Miles, *Stochastic Geometry*, D. G. Kendall and E. F. Harding, eds. (John Wiley: New York, 1974).
- [167] P. Molho, private communication.
- [168] P. Molho, J. Gouzerh, J. C. S. Levy, and J. L. Porteseil, "Topological hysteresis in stripe domain structures," *J. Mag. & Mag. Materials*, vol. 54-57, pp. 857–858, 1986.
- [169] B. Moore, C. M. Knobler, D. Broseta, and F. Rondelez, "Studies in Phase transitions in Langmuir Monolayers by Fluorescence Microscopy," *J. Chem. Soc. Faraday. Trans.*, vol. 2 82, pp. 1753–1761, 1986.
- [170] O. G. Mouritsen, "Universal aspects of domain-growth kinetics," *Annealing Processes—Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 457–462.
- [171] J. E. Morral and M. F. Ashby, "Dislocated cellular structures," *Acta. Met.*, vol. 22, pp. 567–575, 1974.

- [172] W. W. Mullins, "Two-Dimensional Motion of Idealized Grain Boundaries," *J. Appl. Phys.*, vol. 27, pp. 900-904, 1956.
- [173] W. W. Mullins, "The statistical self-similarity hypothesis in grain growth and particle coarsening," *J. Appl. Phys.*, vol. 59, pp. 1341-1349, 1986.
- [174] W. W. Mullins, "On Idealized Two Dimensional Grain Growth," *Scripta. Met.*, vol. 22, pp. 1441-1451, 1988
- [175] W. W. Mullins and R. F. Sekerka, "Morphological Stability of a Particle Growing by Diffusion or Heat Flow," *J. Appl. Phys.*, vol. 34, pp. 323-329, 1963.
- [176] K. J. Mysels, K. Shinoda, and S. Frankel, *Soap Films: Studies of their Thinning and a Bibliography*, (Pergamon Press: New York, 1959).
- [177] F. R. N. Nabarro, *Theory of Crystal Dislocations*, (Oxford: London, 1967).
- [178] T. Nagai, K. Kawasaki, and K. Nakamura, "Dynamics of two dimensional cell patterns," *Nihon Butsuri Gakkaishi*, vol. 43, pp. 437-444, 1988 (in Japanese).

- [179] K. Nakashima, T. Nagai, and K. Kawasaki, "Scaling Behavior of Two-dimensional Domain Growth: Computer Simulation of Vertex Models," (preprint) 1988.
- [180] O. B. Nasello and E. A. Ceppi, "Computer simulation of bidimensional grain boundary migration (II): An application to grain growth," in *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society: Warrendale, 1986), pp. 13-20.
- [181] J. von Neumann, "Discussion," in *Metal Interfaces*, (American Society for Metals: Cleveland, 1952), pp. 108-110.
- [182] I. Newton, "Answers to Some Considerations Upon His Doctrine of Light and Colours," *Phil. Trans. Roy. Soc. London*, vol. 7, pp. 5084-5103, 1672.
- [183] V. Yu. Novikov, "Computer simulation of normal grain growth," *Acta. Met.*, vol. 26, pp. 1739-1744, 1978.
- [184] V. Yu. Novikov, "On computer simulation of texture development in grain growth," *Acta. Met.*, vol. 27, pp. 1461-1466, 1979.
- [185] R. Occelli, E. Guazzelli, and J. Pantaloni, "Order in convective structures," *J. Phys. Lett. (Paris)*, vol. 44, pp. L567-L580, 1983.

- [186] T. H. O'Dell, "Magnetic bubble domain devices," *Rep. Prog. Phys.*, vol. 49, pp. 589–620, 1986.
- [187] T. H. O'Dell, "The Dynamics of Magnetic Bubble Domain Arrays," *Philos. Mag.*, vol. 27, pp. 595–606, 1973.
- [188] R. Peters and K. Beck, "Translational diffusion in phospholipid monolayers measured by fluorescence microphotolysis," *Proc. Natl. Acad. Sci. USA*, vol. 80, pp. 7183–7187, 1983.
- [189] J. Plateau, "Memoir on the Phenomena Presented by a Mass of Liquid Free and Removed from the Action of Gravity," *Mem. Acad. Roy. Belg.*, vol. 16, 1843, continuing in subsequent issues through 1872 (in French).
- [190] J. Plateau, *Statique Experimentale et Theorique des Liquides Soumis aux Seules Forces Moleculaires* (Gauthier-Villars, Paris: 1873).
- [191] D. C. Pieri, "Lineament and polygon patterns on Europa," *Nature*, vol. 289, pp. 17–21, 1981.
- [192] V. Randle, D. Ralph, and N. Hansen, "Grain growth in crystalline materials," *Annealing Processes— Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 123–142.

- [193] Lord Rayleigh, "On the Theory of Surface Forces," *Philos. Mag.*, vol. 30, pp. 285–299 and 456–475, 1890.
- [194] F. N. Rhines, K. R. Craig, and R. T. DeHoff, "Mechanism of Steady-State Grain Growth in Aluminum," *Met. Trans.*, vol. 5, pp. 413–425, 1974.
- [195] F. N. Rhines and K. R. Craig, "Author's Reply," *Met. Trans.*, vol. 6A, pp. 590–591, 1975. Reply to comment of Doherty.⁵⁸
- [196] F. N. Rhines and B. R. Patterson, "Effect of the Degree of Prior Cold Work on the Grain Volume Distribution and the Rate of Grain Growth of Recrystallized Aluminum," *Met. Trans.*, vol. 13A, pp. 985–993, 1982.
- [197] N. Rivier, "Disclination Lines in Glasses," *Philos. Mag.*, vol. A 40, pp. 859–868, 1979.
- [198] N. Rivier, "On the structure of random tissues or froths, and their evolution," *Philos. Mag.*, vol. B 47, pp. L45–L49, 1983.
- [199] N. Rivier, "Statistical crystallography: Structure of random cellular networks," *Philos. Mag.*, vol. B 52, pp. 795–819, 1985.
- [200] N. Rivier, private communication.
- [201] N. Rivier and A. Lissowski, "On the correlation between sizes and shapes of cells in epithelial mosaics," *J. Phys. A*, vol. 15, pp. L143–L148, 1982.

- [202] P. S. Sahni, G. S. Grest, M. P. Anderson, and D. J. Srolovitz, "Kinetics of the Q -State Potts Model in Two Dimensions," *Phys. Rev. Lett.*, vol. 50, pp. 263–266, 1983.
- [203] T. Senuma and H. Yada, "Microstructural evolution of plain carbon steels in multiple hot working," *Annealing Processes—Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 547–552.
- [204] J. F. Shackelford, "Triangle Rafts—Extended Zachariasen schematics for structure modeling," *J. non-Cryst. Sol.*, vol. 49, pp. 19–28, 1982.
- [205] C. J. Simpson, K. T. Aust, and W. C. Winegard, "Activation Energies for Normal Grain Growth in Lead and Cadmium Base Alloy," *Met. Trans.*, vol. 2, pp. 993–997, 1971.
- [206] C. S. Smith, "Grain shapes and other metallurgical applications of topology," in *Metal Interfaces*, (American Society for Metals: Cleveland, 1952), pp. 65–108.
- [207] C. S. Smith, "The Shape of Things," *Sci. Am.*, vol. 190, pp. 58–64, 1954.

- [208] C. S. Smith, "Structure, Substructure, and Superstructure," *Rev. Mod. Phys.*, vol. 36, pp. 524–532, 1964.
- [209] C. S. Smith, "Some elementary principles of polycrystalline microstructure," *Met. Rev.*, vol. 9, pp. 1–48, 1964.
- [210] A. Soares, A. C. Ferro, and M. A. Fortes, "Computer simulation of grain growth in a bidimensional polycrystal," *Scripta. Met.*, vol. 19, pp. 1491–1496, 1985.
- [211] S. E. Soliman, N. Hansen, I. Misfeldt, J. G. Rasmussen, and O. T. Sørensen, "Isothermal grain-growth kinetics in UO_2 ," *Annealing Processes—Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 553–560.
- [212] D. Sornette, "Undulation instability in stripe domain structures of 'bubble' material," *J. Phys. (Paris)*, vol. 48, pp. 151–165, 1987.

- [213] R. Souèges, "Embyogénie des Géraniacées. Développement de l'embryon chez le *Geranium molle* L.," *C. R. Acad. Sci.*, vol. 177, pp. 556–558, 1923.
- [214] A. Spry, "The origin of columnar jointing, particularly in basalt flows," *J. Geol. Soc. Australia*, vol. 8, pp. 191–216, 1961.
- [215] D. J. Srolovitz, "Grain growth phenomena in films: A Monte Carlo approach," *J. Vac. Sci. Technol.*, vol. A4, pp. 2925–2931, 1986.
- [216] D. J. Srolovitz, M. P. Anderson, G. S. Grest, and P. S. Sahni, "Grain growth in two dimensions," *Scripta. Met.*, vol. 17, pp. 241–246, 1983.
- [217] D. J. Srolovitz, M. P. Anderson, P. S. Sahni, and G. S. Grest, "Computer simulation of grain growth—II. Grain size distribution, topology, and local dynamics," *Acta. Met.*, vol. 32, pp. 793–802, 1984.
- [218] D. J. Srolovitz, M. P. Anderson, G. S. Grest, and P. S. Sahni, "Computer simulation of grain growth—III. Influence of a particle dispersion," *Acta. Met.*, vol. 32, pp. 1429–1438, 1984.
- [219] D. J. Srolovitz, G. S. Grest, and M. P. Anderson, "Computer simulation of grain growth—V. Abnormal grain growth." *Acta. Met.*, vol. 33, pp. 2233–2247, 1985.

- [220] J. Stavans and J. A. Glazier, "Soap Froth Revisited: Dynamic Scaling in the Two-Dimensional Froth," *Phys. Rev. Lett.*, vol. 62, pp. 1318–1321, 1989.
- [221] P. S. Stevens, *Patterns in Nature*, (Atlantic Monthly Press: Boston, 1974).
- [222] C. J. Talbot and M. D. A. Jackson, "Salt Tectonics," *Sci. Am.*, vol. 257 August, pp. 70–79, 1987.
- [223] H. Telley, T. M. Liebling, and A. Mocellin, "Simulation of grain growth in 2-dimensions: Influence of the energy expression for the grain boundary network," *Annealing Processes– Recovery, Recrystallization and Grain Growth, Proceedings of the 7th Risø International Symposium on Metallurgy and Materials Science*, N. Hansen, D. J. Jensen, T. Leffers, and B. Ralph, eds. (Risø National Laboratory: Roskilde, 1986), pp. 573–578.
- [224] A. A. Thiele, "The Theory of Cylindrical Magnetic Domains," *Bell Tech. J.*, vol. 48, pp. 3287–3335, 1969.

- [225] A. A. Thiele, "Device Implications of the Theory of Cylindrical Magnetic Domains," *Bell Tech. J.*, vol. 50, pp. 725-773, 1971.
- [226] A. A. Thiele, A. H. Bobeck, E. Della Torre, and U. F. Gianola, "The energy and general translation force of cylindrical magnetic domains," *Bell Tech. J.*, vol. 50, pp. 711-724, 1971.
- [227] C. V. Thompson, "Secondary grain growth in thin films of semiconductors: Theoretical aspects," *J. Appl. Phys.*, vol. 58, pp. 763-772, 1985.
- [228] Sir W. Thomson, "On the Division of Space with Minimum Partitional Area," *Philos. Mag.*, vol. 24, pp. 503-514, 1887.
- [229] C. V. Thompson, H. J. Frost, and F. Speapen, "The Relative Rates of Secondary and Normal Grain Growth," *Acta. Met.*, vol. 35, pp. 887-890, 1987.
- [230] Sir D. Thompson, *On Growth and Form*, 2nd edition, (Cambridge University Press: Cambridge, 1942).
- [231] P. W. Voorhees, "The Theory of Ostwald Ripening," *J. Stat. Phys.*, vol. 38, pp. 231-252, 1985.
- [232] N. v. Raschevsky, "Zur Theorie der spontanen Teilung von mikroskopischen Tropfen," *Z. Phys.*, vol. 46, pp. 587-593, 1928.

- [233] N. v. Raschevsky, "Zur Theorie der spontanen Teilung von mikroskopischen Tropfen. II," *Z. Phys.*, vol. 48, pp. 513–529, 1928.
- [234] N. v. Raschevsky, "Über eine für die Biophysik interessante Art von Hysterese," *Z. Phys.*, vol. 63, pp. 666–671, 1936.
- [235] M. Warner and R. M. Hornreich, "The stability of quasi 2D lattices of magnetic holes," *J. Phys. A*, vol. 18, pp. 2325–2341, 1985.
- [236] D. Weaire, "Some Remarks on the Arrangement of Grains in a Polycrystal," *Metallography*, vol. 7, pp. 157–160, 1974.
- [237] D. Weaire, "On the Ultimate Form of Cells in a Two-dimensional Soap Froth," (preprint) 1986.
- [238] D. Weaire, "Fizz and froth: how the bubbles take the strain," *New Scientist*, vol. 116, 7 October, p. 33, 1987.
- [239] D. Weaire, "A Note on the Elastic Behavior of Ordered Hexagonal Froth," (preprint) 1989.
- [240] D. Weaire and T-L Fu, "The Mechanical Behavior of Foams and Emulsions," (preprint) 1988.
- [241] D. Weaire, T-L Fu, and J. P. Kermode, "On the Shear Elastic Constant of a Two-Dimensional Froth," (preprint) 1988.

- [242] D. Weaire and J. P. Kermode, "The evolution of the structure of a two-dimensional soap froth," *Philos. Mag.*, vol. B 47, pp. L29–L31, 1983.
- [243] D. Weaire and J. P. Kermode, "Computer Simulation of a two-dimensional soap froth: I. Method and motivation," *Philos. Mag.*, vol. B 48, pp. 245–259, 1983.
- [244] D. Weaire and J. P. Kermode, "Computer simulation of a two-dimensional soap froth, II. Analysis of results," *Philos. Mag.*, vol. B 50, pp. 379–388, 1984.
- [245] D. Weaire and J. P. Kermode, "On the distribution of cell areas in a Voronoi network," *Philos. Mag.*, vol. B 53, pp. L101–L105, 1986.
- [246] D. Weaire and C. O'Carroll, "A new model for the Giant's Causeway," *Nature*, vol. 302, pp. 240–241, 1983.
- [247] D. Weaire and N. Rivier, "Soap, Cells and Statistics—Random patterns in Two Dimensions," *Contemp. Phys.*, vol. 25, pp. 59–99, 1984.
- [248] D. Weaire and J. Wejchert, *Computer Simulation of Microstructural Evolution*, (The Metallurgical Society: Warrendale, 1986), pp. 49–60.

- [249] J. Wejchert, D. Weaire, and J. P. Kermode, "Monte Carlo simulation of the evolution of a two-dimensional soap froth," *Philos. Mag.*, vol. B 53, pp. 15-24, 1986.
- [250] P. L. White and L. H. Van Vlack, "A Comparison of Two- and Three-Dimensional Size Distributions in a Cellular material," *Metallography*, vol. 3, pp. 241-258, 1970.
- [251] J. A. Whitehead, Jr., "A survey of hydrodynamic instabilities," in *Fluctuations, Instabilities and Phase Transitions, Proceedings of the NATO Advanced Study Institute, Geilo, Norway, 1975*, T. Riste, ed. (Plenum Press: New York, 1975), pp. 153-180.
- [252] W. M. Williams and C. S. Smith, "A Study of Grain Shape in an Aluminum Alloy And Other Applications of Stereographic Micro-radiography," *Journal of Metals*, vol. 194, pp. 755-765, 1952.
- [253] G. R. Woolhouse and P. Chaudhari, "Two-dimensional lattice simulation by magnetic bubbles," *Philos. Mag.*, vol. 28, pp. 161-172, 1974.

- [254] P. J. Wray, O. Richmond, and H. I. Morrison, "Use of the Dirichlet Tessellation for Characterizing and Modeling Nonregular Dispersions of Second-Phase Particles," *Metallography*, vol. 16, pp. 39-58, 1983.
- [255] A. C. Wright, G. A. N. Connell and J. W. Allen, "Amorphography and the modeling of amorphous solid structures by geometric transformations," *J. non-Cryst. Sol.*, vol. 42, pp. 69-86, 1980.
- [256] A. C. Wright, "Basic amorphography," in *Coherence and Energy Transfer in Glasses*, P. A. Fleury and B. Golding, eds. (Plenum Press: New York, 1982), pp. 1-38.
- [257] J. I. Yellott, Jr., "Spectral Consequences of Photoreceptor Sampling in the Rhesus Retina," *Science*, vol. 221, pp. 382-385, 1983.
- [258] W. H. Zachariasen, "The atomic arrangement in glass," *J. Am. Chem. Soc.*, vol. 54, pp. 3841-3851, 1932.