UNIVERSITY OF AMSTERDAM

# UvA-DARE (Digital Academic Repository)

## Crystallization from mixed salts solutions

Lépinay, S.E.G.

**Publication date**
2024

Link to publication

**Citation for published version (APA):**
Lépinay, S. E. G. (2024). *Crystallization from mixed salts solutions*. [Thesis, fully internal, Universiteit van Amsterdam].

**General rights**
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

**Disclaimer/Complaints regulations**
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: https://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, P.O. Box 19185, 1000 GD Amsterdam, The Netherlands. You will be contacted as soon as possible.

*UvA-DARE is a service provided by the library of the University of Amsterdam (https://dare.uva.nl)*

Download date:14 Oct 2026

# Acknowledgements

In embarking on this academic endeavor, I've been surrounded by a supportive network of individuals and communities that have profoundly impacted my journey.

First and foremost, my deepest appreciation goes to my family, whose unwavering support and encouragement have provided the foundation upon which I've built my aspirations.

I am indebted to my supervisors, Noushine for her patience, strength and everything she taught me. Your passion for science and your achievements will always be impressive to me. You have not only made me a better researcher but also shaped my professional trajectory. To Krassimir, for his attention to detail and his knowledge of broad topics around food science. I want to thanks both of them for their invaluable mentorship.

The writing of papers in collaboration with - Daniel, Antoine D., Marius, Hans, and Chen - has been both intellectually stimulating and immensely rewarding. Our collective efforts have resulted in work that I am truly proud of.

To the students I worked with - Tess, Isa, Anne and Manon - your enthusiasm and curiosity have been a constant source of inspiration. It's been a privilege to learn and grow alongside you. I hope you had as much fun as I had working together. I might not always be clear in my explanations, but I appreciated giving you a part of what I learned along the way.

The vibrant community within Noushine's Group - including Romane, Rozeline, Menno, Anne, Alexander and Paul - has provided me with invaluable support and camaraderie. I will miss our "regular" Thursday meetings where pastries, small talks crossed over deep scientific conversations without skipping a beat. Despite always having the cleanest lab, I think there will always be a few (rusty) marks of friendship leftover.

I am grateful for the friendships forged with office mates - Abhishek, Dong Dong, Nick, Marion, Piet, Thijs, Rinse, Heleen and Andreas. Your companionship and support have made even the most challenging days more bearable.

Beyond academic purposes, my experiences with the diverse smaller groups of friends Marseille, Hiking, Bouldering and Thanksgiving Groups have offered moments of joy and connection. Felipe, Jackson and Antoine P., always remember to do your thing. Hiking for the first time in the Alps with the Melon crate was an unforgettable experience. As well, "Every" Tuesday, I was looking forward to go bouldering with Wenfeng and Yuandou.

The intellectual exchange and camaraderie within the Soft Matter Group and the broader institure have broadened my perspectives. I want to try and thank everyone including Antoine G., Daniel, Elham, Ellen, Hugo, Jared, Kaili, Kasra, Liang, Madeline, Marie, Rosa, Stefan, Tom, Tommaso, Vera and Marco, Ina, Clara, Camila, Karina. Thank you for the lighthearted moments and shared laughter that have provided much-needed balance amidst the rigors of academia.

Overall, I want to thank the whole Institute of Physics for everything over the years. Specifically, I am grateful for the opportunities for community-building and personal development I got via the PhD Council along with Alberto, Alexander, Eleanor, Francesca, Rebekka and Robert. I am grateful for the opportunity to get out of my comfort zone and to help organize the diverse events like the Pizza lunches IoP Drinks. This and plenty of other parts of my PhD would not have been possible without the work of Astrid, Jirina, Rose and Klaartje, and Joost.

Finally, I want to mention my support from abroad with my "infrequent" travels to Brussels and beyond: Mathilde, Leo, Diane, Juliette, Adrien, Cecile, Anatole, Samuel, Vincent, Max, Mus, Antoine B. Florence, Baptiste and Clemence.

To each person and community mentioned, and to those unmentioned but equally valued, I extend my deepest gratitude. Your support, encouragement, and companionship have been integral to my success, and for that, I am truly thankful.

Funding from this project was granted from the public-private partnership "IRONTECH" and was financed by participating industrial partners Unilever Research and Development Wageningen, Nouryon Chemicals B.V., Nobian B.V. and allowances of the Netherlands Organization for Scientific Research (NWO) in the framework of the Innovation Fund for Chemistry and from the Ministry of Economic Affairs in the framework of the "TKI/ PPS—Toeslagregeling". Project number 731.017.205 of the research program TA which is (partly) financed by the Dutch Research Council (NWO).

# List of publications

## As part of this thesis

**Chapter 2:** **Lepinay, Simon E. G.** and Deblais, Antoine and Habibi, Mehdi and Bonn, Daniel and Shahidzadeh, Noushine. "Capillary Forces Lead to Pendant Crystals at the Liquid–Air Interface of Evaporating Salt Solutions" In: *Langmuir*, 39, 50 (2023). (2022)DOI:10.1021/acs.langmuir.3c01830
**L.S.E.G.** performed the experiments, and all authors contributed to the analysis and the writing and revision of the manuscript.

**Chapter 3:** **Lepinay, Simon E. G.** and Nijveld, Raymond and Velikov, Krassimir P. and Shahidzadeh, Noushine. "NaCl Crystals as Carriers for Micronutrient Delivery". In: *ACS Omega*, 7, 7 (2022) DOI:10.1021/acsomega.2c02572
**L.S.E.G.** performed the experiments, N.R. performed the ICP measurements, and all authors contributed to the analysis and the writing and revision of the manuscript.

**Chapter 4:** **Lepinay Simon E. G.**, Claude, Anne, Kolpakov Paul, Hervet, Manon, Nijveld, Raymond, Velikov, Krassimir P., Shahidzadeh, Noushine. "Laboratory Synthesis of D'ansite-(Fe), $Na_{21}Fe(SO_4)_{10}Cl_3$, a polyanionic iron based salt.".
*Submitted, to be published*
**L.S.E.G.**, C.A. and H.M. performed the experiments, N.R. performed the ICP measurements, and all authors contributed to the analysis and the writing and revision of the manuscript.

**Chapter 5:** **Heeremans, Tess**, **Lepinay, Simon E. G.**, Yusuf, Isa, Kolpakov, Paul, Le Dizès-Castell, Romane, Steiger, Michael, Velikov, Krassimir P. and Shahidzadeh, Noushine. "Controlled spherulitic crystal growth from salt mixtures".
*In preparation, to be published*
**H.T**, **L.S.E.G.** contributed equally to study conception, experiments and writing with help from Y.I, K.P and L.C.R helped with viscosity experiment and analysis, S.M. modelled solubility data, and all authors contributed the editing and revision of the manuscript.

# Outside of this work

- Bittermann, Marius R. and Deblais, Antoine and Lépinay, Simon and Bonn, Daniel and Shahidzadeh, Noushine, Deposits from Evaporating Emulsion Drops. In *Scientific Reports*, 1, 1 (2020). DOI:10.1038/s41598-020-71964-1

- Terwisscha-Dekker, Hans and Grzelka, Marion and Lépinay, Simon and Bonn, Daniel. How Does 'Gecko Tape' Work?. In *Biotribology*, 26, 100179 (2021). DOI:10.1016/j.biotri.2021.100179

- Xiao, Chen and Elam, Fiona and van Vliet, Stefan and Bliem, Roland and Lépinay, Simon and Shahidzadeh, Noushine and Weber, Bart and Franklin, Steve. In *Carbon*, 200, 1-9 (2022). DOI:10.1016/j.carbon.2022.08.038

# Bibliography


[1] Bart Kahr, Alexander G. Shtukenberg, Bart Kahr, and Alexander G. Shtukenberg. "Histories of Crystallography by Shafranovskii and Schuh". In: *Recent Advances in Crystallography*. IntechOpen, 2012. DOI: 10.5772/48789 (cit. on p. 11).

[2] Edward Prince, ed. *International Tables for Crystallography. C: Mathematical, Physical and Chemical Tables / Ed. by E. Prince*. 3. ed. Dordrecht: Kluwer Academic, 2004 (cit. on p. 11).

[3] Johann Gottlob von Kurr. *The Mineral Kingdom*. Edmonston and Doublas, 1859 (cit. on p. 12).

[4] Theodore George Wormley. *Micro-Chemistry of Poisons: Including Their Physiological, Pathological, and Legal Relations; with an Appendix on the Detection and Microscopic Discrimination of Blood: Adapted to the Use of the Medical Jurist, Physician, and General Chemist*. J. B. Lippincott Company, 1885 (cit. on p. 12).

[5] Terry Threlfall. "Structural and Thermodynamic Explanations of Ostwald's Rule". In: *Organic Process Research & Development* 7.6 (2003), pp. 1017–1027. DOI: 10.1021/op030026l (cit. on p. 16).

[6] Peter T. Cardew. "Ostwald Rule of Stages-Myth or Reality?" In: *Crystal Growth & Design* 23.6 (2023), pp. 3958–3969. DOI: 10.1021/acs.cgd.2c00141 (cit. on p. 16).

[7] James J. De Yoreo. "Casting a Bright Light on Ostwald's Rule of Stages". In: *Proceedings of the National Academy of Sciences* 119.7 (2022), e2121661119. DOI: 10.1073/pnas.2121661119 (cit. on p. 16).

[8] Mónia A. R. Martins, Simão P. Pinho, and João A. P. Coutinho. "Insights into the Nature of Eutectic and Deep Eutectic Mixtures". In: *Journal of Solution Chemistry* 48.7 (2019), pp. 962–982. DOI: 10.1007/s10953-018-0793-1 (cit. on p. 16).

[9] Stephanie J. Urwin, Guillaume Levilain, Ivan Marziano, Jeremy M. Merritt, Ian Houson, and Joop H. Ter Horst. "A Structured Approach To Cope with Impurities during Industrial Crystallization Development". In: *Organic Process Research & Development* 24.8 (2020). Number: 8, pp. 1443–1456. DOI: 10.1021/acs.oprd.0c00166 (cit. on pp. 17, 53).

[10] A. R. Denton and N. W. Ashcroft. "Vegard's Law". In: *Physical Review A* 43.6 (1991), pp. 3161–3164. DOI: 10.1103/PhysRevA.43.3161 (cit. on p. 17).

[11] Fermín Otálora and JuanMa García-Ruiz. "Nucleation and Growth of the Naica Giant Gypsum Crystals". In: *Chemical Society Reviews* 43.7 (2014), pp. 2013–2026. DOI: 10.1039/C3CS60320B (cit. on p. 18).

[12] Julie Desarnaud, Hannelore Derluyn, Jan Carmeliet, Daniel Bonn, and Noushine Shahidzadeh. "Metastability Limit for the Nucleation of NaCl Crystals in Confinement". In: *The Journal of Physical Chemistry Letters* 5.5 (2014), pp. 890–895. DOI: 10.1021/jz500090x (cit. on p. 18).

[13] Sooheyong Lee, Haeng Sub Wi, Wonhyuk Jo, Yong Chan Cho, Hyun Hwi Lee, Se-Young Jeong, Yong-Il Kim, and Geun Woo Lee. "Multiple Pathways of Crystal Nucleation in an Extremely Supersaturated Aqueous Potassium Dihydrogen Phosphate (KDP) Solution Droplet". In: *Proceedings of the National Academy of Sciences* 113.48 (2016), pp. 13618–13623. DOI: 10.1073/pnas.1604938113 (cit. on p. 18).

[14] Josiah Willard Gibbs. *The Collected Works of J. Willard Gibbs: Thermodynamics*. Yale University Press, 1948 (cit. on p. 19).

[15] Jürn W. P. Schmelzer, Grey Sh. Boltachev, and Vladimir G. Baidakov. "Classical and Generalized Gibbs' Approaches and the Work of Critical Cluster Formation in Nucleation Theory". In: *The Journal of Chemical Physics* 124.19 (2006), p. 194503. DOI: 10.1063/1.2196412 (cit. on p. 19).

[16] K. F. Kelton and A. L. Greer. "Chapter 6 - Heterogeneous Nucleation". In: *Pergamon Materials Series*. Ed. by K. F. Kelton and A. L. Greer. Vol. 15. Nucleation in Condensed Matter. Pergamon, 2010, pp. 165–226. DOI: 10.1016/S1470-1804(09)01506-5 (cit. on p. 19).

[17] Anthony J. Giuffre, Laura M. Hamm, Nizhou Han, James J. De Yoreo, and Patricia M. Dove. "Polysaccharide Chemistry Regulates Kinetics of Calcite Nucleation through Competition of Interfacial Energies". In: *Proceedings of the National Academy of Sciences* 110.23 (2013), pp. 9261–9266. DOI: 10.1073/pnas.1222162110 (cit. on p. 20).

[18] Stefan Auer and Daan Frenkel. "Prediction of Absolute Crystal-Nucleation Rate in Hard-Sphere Colloids". In: *Nature* 409.6823 (2001), pp. 1020–1023. DOI: 10.1038/35059035 (cit. on p. 20).

[19] S.-T. Yau and Peter G. Vekilov. "Direct Observation of Nucleus Structure and Nucleation Pathways in Apoferritin Crystallization". In: *Journal of the American Chemical Society* 123.6 (2001), pp. 1080–1089. DOI: 10.1021/ja003039c (cit. on p. 20).

[20] Christopher E. Killian, Rebecca A. Metzler, Y. U. T. Gong, Ian C. Olson, Joanna Aizenberg, Yael Politi, Fred H. Wilt, Andreas Scholl, Anthony Young, Andrew Doran, Martin Kunz, Nobumichi Tamura, Susan N. Coppersmith, and P. U. P. A. Gilbert. "Mechanism of Calcite Co-Orientation in the Sea Urchin Tooth". In: *Journal of the American Chemical Society* 131.51 (2009), pp. 18404–18409. DOI: 10.1021/ja907063z (cit. on p. 20).

[21] Elia Beniash, Joanna Aizenberg, Lia Addadi, and Stephen Weiner. "Amorphous Calcium Carbonate Transforms into Calcite during Sea Urchin Larval Spicule Growth". In: *Proceedings of the Royal Society of London. Series B: Biological Sciences* 264.1380 (1997), pp. 461–465. DOI: 10.1098/rspb.1997.0066 (cit. on p. 20).

[22] Giulia Mirabello, Alessandro Ianiro, Paul H. H. Bomans, Takuto Yoda, Atsushi Arakaki, Heiner Friedrich, Gijsbertus de With, and Nico A. J. M. Sommerdijk. "Crystallization by Particle Attachment Is a Colloidal Assembly Process". In: *Nature Materials* 19.4 (2020), pp. 391–396. DOI: 10.1038/s41563-019-0511-4 (cit. on p. 20).

[23] Yun-Wei Wang, Hugo K. Christenson, and Fiona C. Meldrum. "Confinement Leads to Control over Calcium Sulfate Polymorph". In: *Advanced Functional Materials* 23.45 (2013), pp. 5615–5623. DOI: 10.1002/adfm.201300861 (cit. on p. 20).

[24] Takayuki Nakamuro, Masaya Sakakibara, Hiroki Nada, Koji Harano, and Eiichi Nakamura. "Capturing the Moment of Emergence of Crystal Nucleus from Disorder". In: *Journal of the American Chemical Society* 143.4 (2021), pp. 1763–1767. DOI: 10.1021/jacs.0c12100 (cit. on p. 20).

[25] James J. De Yoreo, Pupa U. P. A. Gilbert, Nico A. J. M. Sommerdijk, R. Lee Penn, Stephen Whitelam, Derk Joester, Hengzhong Zhang, Jeffrey D. Rimer, Alexandra Navrotsky, Jillian F. Banfield, Adam F. Wallace, F. Marc Michel, Fiona C. Meldrum, Helmut Cölfen, and Patricia M. Dove. "CRYSTAL GROWTH.

Crystallization by Particle Attachment in Synthetic, Biogenic, and Geologic Environments". In: *Science (New York, N.Y.)* 349.6247 (2015), aaa6760. DOI: 10.1126/science.aaa6760 (cit. on pp. 21, 22).

[26] Peter G. Vekilov. "Crystallization Tracked Atom by Atom". In: *Nature* 570.7762 (2019), pp. 450–452. DOI: 10.1038/d41586-019-01965-2 (cit. on pp. 21, 22).

[27] Deniz Erdemir, Alfred Y. Lee, and Allan S. Myerson. "Nucleation of Crystals from Solution: Classical and Two-Step Models". In: *Accounts of Chemical Research* 42.5 (2009), pp. 621–629. DOI: 10.1021/ar800217x (cit. on p. 21).

[28] Rongjin Li, Xiaotao Zhang, Huanli Dong, Qikai Li, Zhigang Shuai, and Wenping Hu. "Gibbs–Curie–Wulff Theorem in Organic Materials: A Case Study on the Relationship between Surface Energy and Crystal Growth". In: *Advanced Materials* 28.8 (2016), pp. 1697–1702. DOI: 10.1002/adma.201504370 (cit. on p. 23).

[29] Pierre Curie. "Sur la formation des cristaux et sur les constantes capillaires de leurs différentes faces". In: *Bulletin de Minéralogie* 8.6 (1885), pp. 145–150. DOI: 10.3406/bulmi.1885.1933 (cit. on p. 23).

[30] G. Wulff. "XXV. Zur Frage der Geschwindigkeit des Wachsthums und der Auflösung der Krystallflächen". In: *Zeitschrift für Kristallographie - Crystalline Materials* 34.1-6 (1901), pp. 449–530. DOI: 10.1524/zkri.1901.34.1.449 (cit. on p. 23).

[31] Makoto Tachibana. *Beginner's Guide to Flux Crystal Growth*. NIMS Monographs. Tokyo: Springer Japan, 2017. DOI: 10.1007/978-4-431-56587-1 (cit. on p. 23).

[32] M. Volmer. "Thermodynamische Folgerungen ans der Zustandsgleichung für adsorbierte Stoffe". In: *Zeitschrift für Physikalische Chemie* 115U.1 (1925), pp. 253–260. DOI: 10.1515/zpch-1925-11519 (cit. on p. 24).

[33] Allan S. Myerson and Rajiv Ginde. "2 - Crystals, Crystal Growth, and Nucleation". In: *Handbook of Industrial Crystallization (Second Edition)*. Ed. by Allan S. Myerson. Woburn: Butterworth-Heinemann, 2002, pp. 33–65. DOI: 10.1016/B978-075067012-8/50004-5 (cit. on p. 25).

[34] Ana Cameirão. *Croissance Cristalline*. https://nte.mines-albi.fr/CristalGemme/CG4/fr/index.html. MOOC Engineering School Mines d'Albi. 2021 (cit. on p. 25).

[35] Otakar Söhnel and John Garside. *Precipitation: Basic Principles and Industrial Applications*. Elsevier Science & Technology Books, 1992 (cit. on p. 25).

[36] G. Zangari. "Fundamentals of Electrodeposition". In: *Encyclopedia of Interfacial Chemistry*. Ed. by Klaus Wandelt. Oxford: Elsevier, 2018, pp. 141–160. DOI: 10.1016/B978-0-12-409547-2.11700-7 (cit. on p. 26).

[37] Alfons Mersmann. *Crystallization Technology Handbook*. 2nd ed., rev. and expanded. New York: Marcel Dekker, 2001 (cit. on p. 27).

[38] Ichiro Sunagawa. *Crystals: Growth, Morphology, & Perfection*. 1st edition. San Diego: Cambridge University Press, 2007 (cit. on pp. 29, 80, 94).

[39] Juan Garcia-Ruiz and Fermin Otalora. "Crystal Growth in Geology: Patterns on the Rocks". In: 2015, pp. 1–43 (cit. on p. 30).

[40] D.D. Pevelen. "8.4 Physical Separations: Solid-State Forms and Habits of Chiral Substances". In: *Comprehensive Chirality* 8 (2012), pp. 54–62. DOI: 10.1016/B978-0-08-095167-6.00813-2 (cit. on p. 30).

[41] László Gránásy, Tamás Pusztai, György Tegze, James A Warren, and Jack F Douglas. "Growth and form of spherulites". In: *Physical Review E* 72.1 (2005), p. 011605 (cit. on pp. 30, 32, 93).

[42] Alexander G. Shtukenberg, Yuri O. Punin, Erica Gunn, and Bart Kahr. "Spherulites". In: *Chemical Reviews* 112.3 (2012), pp. 1805–1838. DOI: 10.1021/cr200297f (cit. on pp. 31, 32, 80, 94).

[43] JH Magill. "Review spherulites: A personal perspective". In: *Journal of materials science* 36 (2001), pp. 3143–3164 (cit. on pp. 31, 32, 94, 95, 115, 122).

[44] Yuntian Xiao, Wenchao Yang, Ling Zhou, Hongxun Hao, Ying Bao, Qiuxiang Yin, and Chuang Xie. "Growth mechanism of the spherulitic propylthiouracil–kaempferol cocrystal: new perspectives into surface nucleation". In: *CrystEngComm* 23.12 (2021), pp. 2367–2375 (cit. on pp. 31, 95).

[45] Osamu Urakawa, Stephen F Swallen, MD Ediger, and Ernst D von Meerwall. "Self-diffusion and viscosity of low molecular weight polystyrene over a wide temperature range". In: *Macromolecules* 37.4 (2004), pp. 1558–1564 (cit. on pp. 32, 95).

[46] Jacek Siódmiak and Adam Gadomski. "Spherulites: How Do They Emerge at an Onset of Nonequilibrium Kinetic-Thermodynamic and Structural Singularity Addressing Conditions?" In: *Entropy* 24.5 (2022), p. 663. DOI: 10.3390/e24050663 (cit. on pp. 32, 95).

[47] Juuso T Korhonen, Marjo Kettunen, Robin HA Ras, and Olli Ikkala. "Hydrophobic nanocellulose aerogels as floating, sustainable, reusable, and recyclable oil absorbents". In: *ACS applied materials & interfaces* 3.6 (2011), pp. 1813–1816 (cit. on p. 35).

[48] John WM Bush and David L Hu. "Walking on water: biolocomotion at the interface". In: *Annu. Rev. Fluid Mech.* 38 (2006), pp. 339–369 (cit. on pp. 35, 43).

[49] Dominic Vella and L Mahadevan. "The "cheerios effect"". In: *American Journal of Physics* 73.9 (2005), pp. 817–825 (cit. on p. 35).

[50] Eric M. Furst. "Directing colloidal assembly at fluid interfaces". In: *Proceedings of the National Academy of Sciences* 108.52 (2011), pp. 20853–20854. DOI: 10.1073/pnas.1118441109 (cit. on p. 36).

[51] Adam D. Law, Mélodie Auriol, Dean Smith, Tommy S. Horozov, and D. Martin A. Buzza. "Self-Assembly of Two-Dimensional Colloidal Clusters by Tuning the Hydrophobicity, Composition, and Packing Geometry". In: *Phys. Rev. Lett.* 110 (13 2013), p. 138301. DOI: 10.1103/PhysRevLett.110.138301 (cit. on p. 36).

[52] Giuseppe Soligno, Marjolein Dijkstra, and René van Roij. "Self-assembly of cubic colloidal particles at fluid–fluid interfaces by hexapolar capillary interactions". In: *Soft Matter* 14.1 (2018), pp. 42–60 (cit. on p. 36).

[53] Mengdi Zuo, Qimeng Song, Nigar Hajiyeva, Holger Lerch, Jens Bolten, Ulrich Plachetka, Max C. Lemme, and Holger Schönherr. "Effect of Particle Size on the Orientation and Order of Assemblies of Functionalized Microscale Cubes Formed at the Water/Air Interface". In: *Langmuir* 39.25 (2023). PMID: 37310799, pp. 8658–8667. DOI: 10.1021/acs.langmuir.3c00518 (cit. on p. 36).

[54] Dominic Vella. "Floating Versus Sinking". In: *Annual Review of Fluid Mechanics* 47.1 (2015). Number: 1 _eprint: https://doi.org/10.1146/annurev-fluid-010814-014627, pp. 115–135. DOI: 10.1146/annurev-fluid-010814-014627 (cit. on pp. 36, 46).

[55] Kohei Nakajima, Aubery Marchel Tientcheu Ngouabeu, Shuhei Miyashita, Maurice Göldi, Rudolf Marcel Füchslin, and Rolf Pfeifer. "Morphology-induced collective behaviors: dynamic pattern formation in water-floating elements". In: *PloS one* 7.6 (2012), e37805 (cit. on p. 36).

[56] G Morris, SJ Neethling, and JJ Cilliers. "The effects of hydrophobicity and orientation of cubic particles on the stability of thin films". In: *Minerals Engineering* 23.11-13 (2010), pp. 979–984 (cit. on p. 36).

[57] G Morris, SJ Neethling, and JJ Cilliers. "A model for investigating the behaviour of non-spherical particles at interfaces". In: *Journal of colloid and interface science* 354.1 (2011), pp. 380–385 (cit. on p. 36).

[58] Noushine Shahidzadeh, Marthe F. L. Schut, Julie Desarnaud, Marc Prat, and Daniel Bonn. "Salt stains from evaporating droplets". en. In: *Scientific Reports* 5.1 (2015). Number: 1 Publisher: Nature Publishing Group, p. 10335. DOI: 10.1038/srep10335 (cit. on pp. 36, 38, 63, 112).

[59] Lukasz Piatkowski, Zhen Zhang, Ellen HG Backus, Huib J Bakker, and Mischa Bonn. "Extreme surface propensity of halide ions in water". In: *Nature communications* 5.1 (2014), p. 4083 (cit. on p. 36).

[60] Jürn WP Schmelzer and Azat O Tipeev. "Effect of Planar Interfaces on Nucleation in Melting and Crystallization". In: *Entropy* 24.8 (2022), p. 1029 (cit. on p. 36).

[61] Farhan Ullah Khan, Majid Mumtaz, Atiya Hassan, et al. "Laboratory scale study for the control crystallization of sodium chloride pyramid crystals (fleur de sel), prepared by solar salt". In: *Bulletin of the Society of Sea Water Science, Japan* 73.2 (2019), pp. 81–84 (cit. on p. 36).

[62] N Sainz-López, T Boski, and DMR Sampath. "Fleur de sel composition and production: analysis and numerical simulation in an artisanal saltern". In: *Journal of Coastal Research* 35.6 (2019), pp. 1200–1214 (cit. on p. 36).

[63] Tudur Davies and Christophe Raufaste. "Effect of gravity on the orientation and detachment of cubic particles adsorbed at soap film or liquid interfaces". In: *Soft Matter* 17 (29 2021), pp. 6964–6971. DOI: 10.1039/D1SM00793A (cit. on pp. 36, 46).

[64] Dino Aquilano, Linda Pastero, Marco Bruno, and Marco Rubbo. "{100} and {111} forms of the NaCl crystals coexisting in growth from pure aqueous solution". en. In: *Journal of Crystal Growth* 311.2 (2009), pp. 399–403. DOI: 10.1016/j.jcrysgro.2008.11.006 (cit. on p. 36).

[65] P Bennema and O Söhnel. "Interfacial surface tension for crystallization and precipitation from aqueous solutions". In: *Journal of Crystal Growth* 102.3 (1990), pp. 547–556 (cit. on p. 37).

[66] Joseph D Berry, Michael J Neeson, Raymond R Dagastine, Derek YC Chan, and Rico F Tabor. "Measurement of surface and interfacial tension using pendant drop tensiometry". In: *Journal of colloid and interface science* 454 (2015), pp. 226–237 (cit. on p. 37).

[67] Noushine Shahidzadeh-Bonn, Salima Rafai, Daniel Bonn, and Gerard Wegdam. "Salt Crystallization during Evaporation: Impact of Interfacial Properties". In: *Langmuir* 24.16 (2008), pp. 8599–8605. DOI: 10.1021/la8005629 (cit. on pp. 38, 44).

[68] Alok Gautam and Graeme J Jameson. "The capillary force between a bubble and a cubical particle". In: *Minerals Engineering* 36 (2012), pp. 291–299 (cit. on p. 43).

[69] Abraham Marmur. "Solid-surface characterization by wetting". In: *Annual Review of Materials Research* 39 (2009), pp. 473–489 (cit. on p. 44).

[70] Jacob N Israelachvili. *Intermolecular and surface forces*. Academic press, 2011 (cit. on p. 44).

[71] Mohsin J. Qazi, Rinse W. Liefferink, Simon J. Schlegel, Ellen H. G. Backus, Daniel Bonn, and Noushine Shahidzadeh. "Influence of Surfactants on Sodium Chloride Crystallization in Confinement". In: *Langmuir* 33.17 (2017), pp. 4260–4268. DOI: 10.1021/acs.langmuir.7b00244 (cit. on pp. 44, 46, 49).

[72] Lei Li, Felix Kohler, Anja Røyne, and Dag Kristian Dysthe. "Growth of Calcite in Confinement". In: *Crystals* 7.12 (2017). DOI: 10.3390/cryst7120361 (cit. on p. 47).

[73] Francesco Caruso and Robert Flatt. "Further steps towards the solution of Correns' dilemma". In: 2014. DOI: 10.13140/2.1.1176.2569 (cit. on p. 47).

[74] Simon E. G. Lepinay, Raymond Nijveld, Krassimir P. Velikov, and Noushine Shahidzadeh. "NaCl Crystals as Carriers for Micronutrient Delivery". In: *ACS Omega* 7.33 (2022), pp. 28955–28961. DOI: 10.1021/acsomega.2c02572 (cit. on pp. 47, 70, 81).

[75] Majda Bouzid, Lionel Mercury, Arnault Lassin, Jean-Michel Matray, and Mohamed Azaroual. "In-Pore Tensile Stress by Drying-Induced Capillary Bridges inside Porous Materials". In: *Journal of Colloid and Interface Science* 355.2 (2011), pp. 494–502. DOI: 10.1016/j.jcis.2010.12.058 (cit. on p. 49).

[76] Mohsin J Qazi, Simon J Schlegel, Ellen HG Backus, Mischa Bonn, Daniel Bonn, and Noushine Shahidzadeh. "Dynamic surface tension of surfactants in the presence of high salt concentrations". In: *Langmuir* 36.27 (2020), pp. 7956–7964 (cit. on p. 49).

[77] Noushine Shahidzadeh-Bonn, Julie Desarnaud, Francois Bertrand, Xavier Chateau, and Daniel Bonn. "Damage in porous media due to salt crystallization". In: *Phys. Rev. E* 81 (6 2010), p. 066110. DOI: 10.1103/PhysRevE.81.066110 (cit. on p. 49).

[78] Gerard Capellades, Jacob O. Bonsu, and Allan S. Myerson. "Impurity incorporation in solution crystallization: diagnosis, prevention, and control". en. In: *CrystEngComm* 24.11 (2022). Publisher: The Royal Society of Chemistry, pp. 1989–2001. DOI: 10.1039/D1CE01721G (cit. on p. 53).

[79] Anthony Barakat, Shelby Maurice, Cameron Roberts, Mark A. Benvenuto, and Elizabeth S. Roberts-Kirchhoff. "Analysis of Salts and Salt Substitutes with a Handheld X-Ray Fluorescence Analyzer". In: *Trace Materials in Air, Soil, and Water*. Vol. 1210. ACS Symposium Series 1210. American Chemical Society, 2015, pp. 101–114. DOI: 10.1021/bk-2015-1210.ch005 (cit. on p. 54).

[80] Ş. Yalçin and I.H. Mutlu. "Structural Characterization of Some Table Salt Samples by XRD, ICP, FTIR and XRF Techniques". en. In: *Acta Physica Polonica A* 121.1 (2012). Number: 1, pp. 50–52. DOI: 10.12693/APhysPolA.121.50 (cit. on p. 54).

[81] Sant-Rayn Pasricha, Jason Tye-Din, Martina U. Muckenthaler, and Dorine W. Swinkels. "Iron deficiency". English. In: *The Lancet* 397.10270 (2021). Number: 10270 Publisher: Elsevier, pp. 233–248. DOI: 10.1016/S0140-6736(20)32594-0 (cit. on p. 54).

[82] Richard F. Hurrell. "Iron Fortification Practices and Implications for Iron Addition to Salt". eng. In: *The Journal of Nutrition* 151.Supplement_1 (2021). Number: Supplement_1, 3S–14S. DOI: 10.1093/jn/nxaa175 (cit. on p. 54).

[83] Oluwasegun Modupe and Levente L. Diosady. "Quadruple fortification of salt for the delivery of iron, iodine, folic acid, and vitamin B12 to vulnerable populations". In: *Journal of Food Engineering* 300 (2021), p. 110525. DOI: 10.1016/j.jfoodeng.2021.110525 (cit. on p. 54).

[84] Alister Shields and Mohammed Anas Ansari. "Review of Experience of the Production of Salt Fortified with Iron and Iodine". In: *The Journal of Nutrition* 151.Supplement_1 (2021). Number: Supplement_1, 29S–37S. DOI: 10.1093/jn/nxaa279 (cit. on p. 54).

[85] Judith Bijlsma, Wouter J. C. de Bruijn, Jos A. Hageman, Peter Goos, Krassimir P. Velikov, and Jean-Paul Vincken. "Revealing the main factors and two-way interactions contributing to food discolouration caused by iron-catechol complexation". en. In: *Scientific Reports* 10.1 (2020). Number: 1 Publisher: Nature Publishing Group, p. 8288. DOI: 10.1038/s41598-020-65171-1 (cit. on p. 54).

[86] Ruth Blanco-Rojo and M. Pilar Vaquero. "Iron bioavailability from food fortification to precision nutrition. A review". en. In: *Innovative Food Science & Emerging Technologies*. Innovations in Food Science and Technology at the Spanish National Research Council (CSIC) 51 (2019), pp. 126–138. DOI: 10.1016/j.ifset.2018.04.015 (cit. on p. 54).

[87] Boaz Lazar and Heinrich D. Holland. "The analysis of fluid inclusions in halite". In: *Geochimica et Cosmochimica Acta* 52.2 (1988), pp. 485–490. DOI: 10.1016/0016-7037(88)90103-2 (cit. on p. 54).

[88] Tomasz Toboła. "Raman spectroscopy of organic, solid and fluid inclusions in the Oldest Halite of LGOM area (SW Poland)". In: *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 189 (2018), pp. 381–392. DOI: 10.1016/j.saa.2017.08.024 (cit. on p. 54).

[89] FSSAI. "Food Safety and Standards (Fortification of Foods)". In: *Gazette of India, Regulations* Part III.Section 4 (2018) (cit. on pp. 55, 58, 80).

[90] Charles M. Flynn. "Hydrolysis of inorganic iron(III) salts". en. In: *Chemical Reviews* 84.1 (1984). Number: 1, pp. 31–41. DOI: 10.1021/cr00059a003 (cit. on p. 55).

[91] A. Atbir, A. Marrouche, M. El Hadek, R. Cohen-Adad, and MTh Cohen-Adad. "Équilibre solide-liquide du système quaternaire $K^+$, $Na^+$, $Fe^{3+}$ / $Cl^-$ - $H_2O$ à 15 et 30 °C". fr. In: *Journal de Chimie Physique* 94 (1997). Publisher: EDP Sciences, pp. 1274–1285. DOI: 10.1051/jcp/1997941274 (cit. on p. 57).

[92] François Beniere and Ridha Rokbani. "Transport processes in NaCl single crystals doped with a trivalent cation; solubility, association and migration of $Y^{3+}$". In: *Journal of Physics and Chemistry of Solids* 36.11 (1975). Number: 11, pp. 1151–1160. DOI: 10.1016/0022-3697(75)90184-5 (cit. on p. 59).

[93] N Saito, M Yokota, T Fujiwara, and N Kubota. "Liquid inclusions in crystals produced in suspension crystallization". en. In: *Chemical Engineering Journal* 79.1 (2000). Number: 1, pp. 53–59. DOI: 10.1016/S1385-8947(00)00143-1 (cit. on p. 59).

[94] Lea Scholten, Christian Schmidt, Pilar Lecumberri-Sanchez, Matthew Newville, Antonio Lanzirotti, Mona-Liza C. Sirbescu, and Matthew Steele-MacInnis. "Solubility and speciation of iron in hydrothermal fluids". In: *Geochimica et Cosmochimica Acta* 252 (2019), pp. 126–143. DOI: 10.1016/j.gca.2019.03.001 (cit. on pp. 60, 61, 64).

[95] H. E Cline and T. R Anthony. "The shape relaxation of liquid droplets in solids". In: *Acta Metallurgica* 19.3 (1971), pp. 175–180. DOI: 10.1016/0001-6160(71)90144-1 (cit. on pp. 61, 62).

[96] Sergey I. Garmashov. "A model of shapes of liquid cylindrical inclusions migrating through a non-uniformly heated crystal: Fundamentals and applications for studying crystallization and dissolution". In: *Journal of Crystal Growth* 574 (2021), p. 126312. DOI: 10.1016/j.jcrysgro.2021.126312 (cit. on p. 61).

[97] Daniel W Davis, Tim K Lowenstein, and Ronald J Spencer. "Melting behavior of fluid inclusions in laboratory-grown halite crystals in the systems $NaCl$-$H_2O$, $NaCl$-$KCl$-$H_2O$, $NaCl$-$MgCl_2$-$H_2O$, and $NaCl$-$CaCl_2$-$H_2O$". In: *Geochimica et Cosmochimica Acta* 54.3 (1990), pp. 591–601. DOI: 10.1016/0016-7037(90)90355-O (cit. on p. 61).

[98] Reinhard Ploß and Alfons Mersmann. "A new model of the effect of stirring intensity on the rate of secondary nucleation". en. In: *Chemical Engineering & Technology* 12.1 (1989). _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1002/ceat.270120119, pp. 137–146. DOI: 10.1002/ceat.270120119 (cit. on p. 64).

[99] Ida Freund. "Double Salts". In: *Science Progress in the Twentieth Century (1906-1916)* 2.5 (1907). Number: 5, pp. 135–159. URL: https://www.jstor.org/stable/43776609 (cit. on p. 69).

[100] A. V. Yadav, A. S. Shete, A. P. Dabke, P. V. Kulkarni, and S. S. Sakhare. "Co-Crystals: A Novel Approach to Modify Physicochemical Properties of Active Pharmaceutical Ingredients". In: *Indian Journal of Pharmaceutical Sciences* 71.4 (2009). Number: 4, pp. 359–370. DOI: 10.4103/0250-474X.57283 (cit. on pp. 69, 70).

[101] Margaret C. Etter. "Hydrogen Bonds as Design Elements in Organic Chemistry". In: *The Journal of Physical Chemistry* 95.12 (1991), pp. 4601–4610. DOI: 10.1021/j100165a007 (cit. on p. 70).

[102] Dongliang Chao, Wanhai Zhou, Fangxi Xie, Chao Ye, Huan Li, Mietek Jaroniec, and Shi-Zhang Qiao. "Roadmap for advanced aqueous batteries: From design of materials to applications". In: *Science Advances* 6.21 (2020). Publisher: American Association for the Advancement of Science, eaba4098. DOI: 10.1126/sciadv.aba4098 (cit. on p. 70).

[103] Dipan Kundu, Elahe Talaie, Victor Duffort, and Linda F. Nazar. "The Emerging Chemistry of Sodium Ion Batteries for Electrochemical Energy Storage". en. In: *Angewandte Chemie International Edition* 54.11 (2015). _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1002/anie.201410376, pp. 3431–3448. DOI: 10.1002/anie.201410376 (cit. on pp. 70, 85).

[104] W. Kooijman, D. J. Kok, M. A. R. Blijlevens, H. Meekes, and E. Vlieg. "Screening double salt sulfate hydrates for application in thermochemical heat storage". In: *Journal of Energy Storage* 55 (2022), p. 105459. DOI: 10.1016/j.est.2022.105459 (cit. on p. 70).

[105] K. M. Abraham. "How Comparable Are Sodium-Ion Batteries to Lithium-Ion Counterparts?" In: *ACS Energy Letters* 5.11 (2020). Publisher: American Chemical Society, pp. 3544–3547. DOI: 10.1021/acsenergylett.0c02181 (cit. on p. 70).

[106] Marine Reynaud, Mohamed Ati, Sylvain Boulineau, Moulay T. Sougrati, Brent C. Melot, Gwenaëlle Rousse, Jean-Noël Chotard, and Jean-Marie Tarascon. "Bimetallic Sulfates $A_2M(SO_4)_2 \cdot nH_2O$ (A = Li, Na and M = Transition Metal): As New Attractive Electrode Materials for Li- and Na-Ion Batteries". In: *ECS Transactions* 50.24 (2013), p. 11. DOI: 10.1149/05024.0011ecst (cit. on pp. 70, 78).

[107] Eider Goikolea, Verónica Palomares, Shijian Wang, Idoia Ruiz de Larramendi, Xin Guo, Guoxiu Wang, and Teofilo Rojo. "Na-Ion Batteries—Approaching Old and New Challenges". In: *Advanced Energy Materials* 10.44 (2020), p. 2002055. DOI: 10.1002/aenm.202002055 (cit. on p. 70).

[108] Prabeer Barpanda, Gosuke Oyama, Chris Ling, and Atsuo Yamada. "Kröhnkite-Type $Na_2Fe(SO_4)_2 \cdot 2H_2O$ as a Novel 3.25 V Insertion Compound for Na-Ion Batteries". In: *Chemistry of Materials* 26 (2014), pp. 1297–1299. DOI: 10.1021/cm4033226 (cit. on p. 70).

[109] Guruprakash Karkera, M. Anji Reddy, and Maximilian Fichtner. "Recent Developments and Future Perspectives of Anionic Batteries". In: *Journal of Power Sources* 481 (2021), p. 228877. DOI: 10.1016/j.jpowsour.2020.228877 (cit. on p. 70).

[110] Kai Wang, Zhenqi Gu, Zhiwei Xi, Lv Hu, and Cheng Ma. "$Li_3TiCl_6$ as Ionic Conductive and Compressible Positive Electrode Active Material for All-Solid-State Lithium-Based Batteries". In: *Nature Communications* 14 (2023). DOI: 10.1038/s41467-023-37122-7 (cit. on p. 70).

[111] F. Demartin, I. Campostrini, C. Castellano, C. M. Gramaccioli, and M. Russo. "D'ansite-(Mn), $Na_{21}Mn^{2+}(SO_4)_{10}Cl_3$ and d'ansite-(Fe), $Na_{21}Fe^{2+}(SO_4)_{10}Cl_3$, Two New Minerals from Volcanic Fumaroles". In: *Mineralogical Magazine* 76.7 (2012), pp. 2773–2783. DOI: 10.1180/minmag.2012.076.7.10 (cit. on pp. 70, 78, 80, 84, 90).

[112] A Atbir, S Mançour-Billah, and M El Hadek. "Solid–liquid equilibria in the quaternary system $K^+$, $Fe^{2+}$, $Fe^{3+}$ / $Cl^-$–$H_2O$ at 288.15 K". en. In: *Fluid Phase Equilibria* 215.1 (2004). Number: 1, pp. 97–103. DOI: 10.1016/S0378-3812(03)00367-4 (cit. on p. 72).

[113] Erich Königsberger. "Editorial: Guidelines for the Measurement of Solid–Liquid Solubility Data at Atmospheric Pressure". In: *Journal of Chemical & Engineering Data* 64.2 (2019). Number: 2 Publisher: American Chemical Society, pp. 381–385. DOI: 10.1021/acs.jced.8b01263 (cit. on p. 72).

[114] Huan Zhou, Jianbo Zhang, Hongli Zhang, Shuai Zhang, Xiaoqin Bai, and Zuoliang Sha. "Salt-Forming Regions of $Na^+$, $Mg^{2+}$-$Cl^-$, $SO4^{2\breve{}}$–$H_2O$ System at 373.15 K in the Nonequilibrium State of Isothermal Boiling Evaporation". In: *Journal of Chemical & Engineering Data* 57.4 (2012). Publisher: American Chemical Society, pp. 1192–1202. DOI: 10.1021/je201239s (cit. on pp. 73, 82).

[115] Chi Hong Chio, Shiv K. Sharma, and David W. Muenow. "Micro-Raman Studies of Hydrous Ferrous Sulfates and Jarosites". In: *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*. Georaman 2004: Sixth International Conference on Raman Spectroscopy Applied to the Earth and Planetary Sciences 61.10 (2005), pp. 2428–2433. DOI: 10.1016/j.saa.2005.02.021 (cit. on p. 74).

[116] Vadim M. Kovrugin, Diana O. Nekrasova, Oleg I. Siidra, Olivier Mentré, Christian Masquelier, Sergey Yu. Stefanovich, and Marie Colmont. "Mineral-Inspired Crystal Growth and Physical Properties of $Na_2Cu(SO_4)_2$ and Review of $Na_2(SO_4)_2 \cdot xH_2O$ (x = 0–6) Compounds". en. In: *Crystal Growth & Design* 19.2 (2019), pp. 1233–1244. DOI: 10.1021/acs.cgd.8b01658 (cit. on p. 78).

[117] C. Vizcayno and M. T. Garcia-Gonzalez. "$Na_2Mg(SO_4)2 \cdot 4H_2O$, the Mg End-Member of the Bloedite-Type of Mineral". In: *Acta Crystallographica Section C: Crystal Structure Communications* 55.1 (1999), pp. 8–11. DOI: 10.1107/S0108270198011135 (cit. on p. 78).

[118] D. London. "The Barite Roses of Oklahoma". In: *Mineralogical Record* 39 (2008), pp. 277–292 (cit. on p. 80).

[119] Ayan Mukherjee, Tali Sharabani, Rosy Sharma, Sivan Okashy, and Malachi Noked. "Effect of Crystal Structure and Morphology on $Na_3V_2(PO_4)_2F_3$ Performances for Na-Ion Batteries". In: *Batteries & Supercaps* 3.6 (2020), pp. 510–518. DOI: 10.1002/batt.201900202 (cit. on p. 80).

[120] Hoon-Hee Ryu, Soo-Been Lee, Chong S. Yoon, and Yang-Kook Sun. "Morphology-Dependent Battery Performance of Ni-Rich Layered Cathodes: Single-Crystal versus Refined Polycrystal". In: *ACS Energy Letters* 7.9 (2022), pp. 3072–3079. DOI: 10.1021/acsenergylett.2c01670 (cit. on p. 80).

[121] Kevin M. Knowles and Harshad K. D. H. Bhadeshia. "Deltoidal Icositetrahedron Faceting on $\alpha$-Fe Crystals Found on the Surface of the Moon". In: *Journal of Crystal Growth* 617 (2023), p. 127257. DOI: 10.1016/j.jcrysgro.2023.127257 (cit. on p. 80).

[122] M. Hudák, J. G. Díaz, and J. Kožíšek. "Disodium Tetraaquabis(Sulfato)Iron(II)". In: *Acta Crystallographica Section E: Structure Reports Online* 64.2 (2008), pp. i10–i10. DOI: 10.1107/S1600536808000214 (cit. on p. 90).

[123] Alexander G Shtukenberg, Yuri O Punin, Erica Gunn, and Bart Kahr. "Spherulites". In: *Chemical reviews* 112.3 (2012), pp. 1805–1838 (cit. on pp. 94, 95, 113).

[124] Ella Sokol, Elena Nigmatulina, Natalya Maksimova, and Alexander Chiglintsev. "$CaC_2O_4 \cdot H_2O$ spherulites in human kidney stones: morphology, chemical composition, and growth regime". In: *European Journal of Mineralogy* 17.2 (2005), pp. 285–295 (cit. on p. 94).

[125] Usama Al-Atar, Alexei A Bokov, Dan Marshall, Joel MH Teichman, Byron D Gates, Zuo-Guang Ye, and Neil R Branda. "Mechanism of calcium oxalate monohydrate kidney stones formation: layered spherulitic growth". In: *Chemistry of Materials* 22.4 (2010), pp. 1318–1329 (cit. on p. 94).

[126] Mark RH Krebs, Cait E MacPhee, Aline F Miller, Iain E Dunlop, Christopher M Dobson, and Athene M Donald. "The formation of spherulites by amyloid fibrils of bovine insulin". In: *Proceedings of the National Academy of Sciences* 101.40 (2004), pp. 14420–14424 (cit. on p. 94).

[127] Christoph Breitkreuz, Jens Götze, and Alexandra Weißmantel. "Mineralogical and geochemical investigation of megaspherulites from Argentina, Germany, and the USA". In: *Bulletin of Volcanology* 83 (2021), pp. 1–24 (cit. on p. 94).

[128] William Henry Fox Talbot. "IV. Further observations on the optical phenomena of crystals". In: *Philosophical Transactions of the Royal Society of London* 127 (1837), p. 25 (cit. on p. 94).

[129] DC Bassett. "Polymer spherulites: a modern assessment". In: *Journal of Macromolecular Science, Part B* 42.2 (2003), pp. 227–256 (cit. on p. 94).

[130] A Toda. "Spherulitic growth in crystalline polymers". In: *Encyclopedia of polymers and composites* (2013), pp. 1–12 (cit. on p. 94).

[131] Shankun Liang, Yuchao Niu, Xueyan Hu, Wu Xiao, Xuehua Ruan, Gaohong He, and Xiaobin Jiang. "Supersaturation-driven self-assembly formation of ceftriaxone sodium spherulites: From amorphous form to spherulites". In: *Particuology* 90 (2024), pp. 10–19 (cit. on pp. 94, 113).

[132] Saghir Akhtar, Cofin W Pouton, and Lidia J Notarianni. "The influence of crystalline morphology and copolymer composition on drug release from solution cast and melt-processed P (HB-HV) copolymer matrices". In: *Journal of controlled release* 17.3 (1991), pp. 225–233 (cit. on p. 94).

[133] Matthew T Lloyd, Alex C Mayer, Sankar Subramanian, Devin A Mourey, Dave J Herman, Amit V Bapat, John E Anthony, and George G Malliaras. "Efficient solution-processed photovoltaic cells based on an anthradithiophene/fullerene blend". In: *Journal of the American Chemical Society* 129.29 (2007), pp. 9144–9149 (cit. on p. 94).

[134] Ichiro Sunagawa. "Growth histories of mineral crystals as seen from their morphological features". In: *Crystal Growth Technology*. Elsevier, 2003, pp. 1–23 (cit. on p. 94).

[135] Ichiro Sunagawa. *Crystals: growth, morphology, & perfection*. Cambridge University Press, 2007 (cit. on p. 94).

[136] HD Keith and FJ Padden Jr. "A phenomenological theory of spherulitic crystallization". In: *Journal of Applied Physics* 34.8 (1963), pp. 2409–2421 (cit. on p. 94).

[137] William W Mullins and RF Sekerka. "Stability of a planar interface during solidification of a dilute binary alloy". In: *Journal of applied physics* 35.2 (1964), pp. 444–451 (cit. on p. 94).

[138] Nigel Goldenfeld. "Theory of spherulitic crystallization". In: *Journal of crystal growth* 84.4 (1987), pp. 601–608 (cit. on p. 94).

[139] JS Langer. "Dynamics of dendritic pattern formation". In: *Materials science and engineering* 65.1 (1984), pp. 37–44 (cit. on p. 94).

[140] William A Tiller. *The science of crystallization: macroscopic phenomena and defect generation*. Cambridge University Press, 1991 (cit. on p. 95).

[141] Maurits CR Heijna, Mirjam J Theelen, Willem JP van Enckevort, and Elias Vlieg. "Spherulitic growth of hen egg-white lysozyme crystals". In: *The Journal of Physical Chemistry B* 111.7 (2007), pp. 1567–1573 (cit. on p. 95).

[142] Buckley Crist and Jerold M Schultz. "Polymer spherulites: A critical review". In: *Progress in Polymer Science* 56 (2016), pp. 1–63 (cit. on p. 95).

[143] Noushine Shahidzadeh and Julie Desarnaud. "Damage in porous media: role of the kinetics of salt (re) crystallization". In: *The European Physical Journal-Applied Physics* 60.2 (2012), p. 24205 (cit. on p. 97).

[144] Michael Steiger and Sönke Asmussen. "Crystallization of sodium sulfate phases in porous materials: The phase diagram $Na_2SO_4$-$H_2O$ and the generation of stress". In: *Geochimica et Cosmochimica Acta* 72.17 (2008), pp. 4291–4306 (cit. on pp. 99, 100).

[145] Michael Steiger, Jana Kiekbusch, and Andreas Nicolai. "An improved model incorporating Pitzer's equations for calculation of thermodynamic properties of pore solutions implemented into an efficient program code". In: *Construction and Building Materials* 22.8 (2008), pp. 1841–1850 (cit. on pp. 99–101, 121).

[146] Kenneth S Pitzer. "Ion interaction approach: theory and data correlation". In: *Activity coefficients in electrolyte solutions*. CRC Press, 2018, pp. 75–153 (cit. on p. 100).

[147] Daniel Bonn and Noushine Shahidzadeh. "Multistep crystallization processes: How not to make perfect single crystals". In: *Proceedings of the National Academy of Sciences* 113.48 (2016), pp. 13551–13553 (cit. on p. 102).

[148] Yun-Wei Wang, Hugo K Christenson, and Fiona C Meldrum. "Confinement leads to control over calcium sulfate polymorph". In: *Advanced Functional Materials* 23.45 (2013), pp. 5615–5623 (cit. on p. 106).

[149] Alexy P Freitas, Raj Kumar Ramamoorthy, Maxime Durelle, Eric Larquet, Isabelle Maurin, Fabienne Testard, Corinne Chevallard, Thierry Gacoin, and David Carriere. "Crystallization within Intermediate Amorphous Phases Determines the Polycrystallinity of Nanoparticles from Coprecipitation". In: *Nano Letters* 22.1 (2021), pp. 29–35 (cit. on p. 106).

[150] Julie Desarnaud, Hannelore Derluyn, Jan Carmeliet, Daniel Bonn, and Noushine Shahidzadeh. "Hopper growth of salt crystals". In: *The journal of physical chemistry letters* 9.11 (2018), pp. 2961–2966 (cit. on p. 113).

[151] C Jeffrey Brinker and George W Scherer. *Sol-gel science: the physics and chemistry of sol-gel processing*. Academic press, 2013, pp. 21–58 (cit. on pp. 115, 121).

[152] Nadine Lindström, Tanya Talreja, Kirsten Linnow, Amelie Stahlbuhk, and Michael Steiger. "Crystallization Behavior of $Na_2SO_4$-$MgSO_4$ Salt Mixtures in Sandstone and Comparison to Single Salt Behavior". In: *Applied Geochemistry* 69 (2016), pp. 50–70. DOI: 10.1016/j.apgeochem.2016.04.005 (cit. on p. 117).

[153] Alian Wang, John J Freeman, Bradley L Jolliff, and I-Ming Chou. "Sulfates on Mars: A systematic Raman spectroscopic study of hydration states of magnesium sulfates". In: *Geochimica et cosmochimica acta* 70.24 (2006), pp. 6118–6135 (cit. on pp. 117, 118).

[154] M Lenoir, A Grandjean, S Poissonnet, and DR Neuville. "Quantitation of sulfate solubility in borosilicate glasses using Raman spectroscopy". In: *Journal of Non-Crystalline Solids* 355.28-30 (2009), pp. 1468–1473 (cit. on p. 118).

[155] E. R. Jr. Nightingale. "Phenomenological Theory of Ion Solvation. Effective Radii of Hydrated Ions". In: *The Journal of Physical Chemistry* 63.9 (1959), pp. 1381–1387. DOI: 10.1021/j150579a011 (cit. on p. 123).

[156] PM Kobylin, Hannu Sippola, and PA Taskinen. "Thermodynamic modelling of aqueous Fe (II) sulfate solutions". In: *Calphad* 35.4 (2011), pp. 499–511 (cit. on pp. 123, 124).

[157] Michael Steiger, Kirsten Linnow, Dorothee Ehrhardt, and Mandy Rohde. "Decomposition reactions of magnesium sulfate hydrates and phase equilibria in the $MgSO_4$-$H_2O$ and $Na^+$-$Mg^{2+}$-$Cl^-$-$SO_4^{2-}$-$H_2O$ systems with implications for Mars". In: *Geochimica et Cosmochimica Acta* 75.12 (2011), pp. 3600–3626 (cit. on pp. 123, 124).

[158] MR Bittermann, A Deblais, S Lépinay, D Bonn, and N Shahidzadeh. "Deposits from evaporating emulsion drops". In: *Scientific reports* 10.1 (2020), p. 14863.

[159] Hans Terwisscha-Dekker, Marion Grzelka, Simon Lépinay, and Daniel Bonn. "How Does 'Gecko Tape' Work?" In: *Biotribology* 26 (2021), p. 100179. DOI: 10.1016/j.biotri.2021.100179.

[160] Chen Xiao, Fiona Elam, Stefan van Vliet, Roland Bliem, Simon Lépinay, Noushine Shahidzadeh, Bart Weber, and Steve Franklin. "Intercrystallite Boundaries Dominate the Electrochemical Corrosion Behavior of Polycrystalline Diamond". In: *Carbon* 200 (2022), pp. 1–9. DOI: 10.1016/j.carbon.2022.08.038.