
References

- Abeywardana, D. B. W., Hredzak, B., & Agelidis, V. G. (2015). Single-Phase Grid-Connected LiFePO₄ Battery-Supercapacitor Hybrid Energy Storage System With Interleaved Boost Inverter. *IEEE Transactions on Power Electronics*, 30(10), 5591–5604. <https://doi.org/10.1109/TPEL.2014.2372774>
- Abraham, K. M. (2020a). How Comparable Are Sodium-Ion Batteries to Lithium-Ion Counterparts? *ACS Energy Letters*, 5(11), 3544–3547. <https://doi.org/10.1021/acscenergylett.0c02181>
- Addison, C. C. (2003). Liquid Alkali Metals. In R. A. Meyers (Ed.), *Encyclopedia of Physical Science and Technology (Third Edition)* (pp. 661–671). Academic Press. <https://doi.org/https://doi.org/10.1016/B0-12-227410-5/00970-4>
- Amanda MacMillan Jeff Turrentine. (2021). *Global Warming 101*.
- Amlan roy, Ananta sarkar, Supriya Sau, N Abharana, Sagar Mitra, Sodium ion battery full cell study with molybdenum selenide porous carbon [NC@MoSe₂@rGO] composite anode and intercalated sodium vanadium fluorophosphate [Na₃(VO)₂(PO₄)₂F] cathode, *Batteries & supercaps*; 4(6978-988, 2021)
- Ananthanarayanan, V. (1968). Studies on the Vibrational Spectrum of the SO₄ = Ion in Crystalline M₂M'(SO₄)₂·6H₂O (M' = K or NH₄ and M'' = Mg, Zn, Ni, or Co): Observations on the Symmetry of the Sulfate Ion in Crystals. *The Journal of Chemical Physics*, 48(2), 573–581. <https://doi.org/10.1063/1.1668686>
- Avdeev, M., Mohamed, Z., Ling, C. D., Lu, J., Tamaru, M., Yamada, A., & Barpanda, P. (2013). Magnetic structures of NaFePO₄ maricite and triphylite polymorphs for sodium-ion batteries. *Inorganic Chemistry*, 52(15), 8685–8693. <https://doi.org/10.1021/ic400870x>
- Balić-Žunić, T., Garavelli, A., Acquafredda, P., Leonardsen, E., & Jakobsson, S. P. (2009). Eldfellite, NaFe(SO₄)₂, a new fumarolic mineral from Eldfell volcano, Iceland. *Mineralogical Magazine*, 73(1), 51–57. <https://doi.org/10.1180/minmag.2009.073.1.51>
- Barpanda, P., Liu, G., Ling, C. D., Tamaru, M., Avdeev, M., Chung, S. C., Yamada, Y., & Yamada, A. (2013a). Na₂FeP₂O₇: A safe cathode for rechargeable sodium-ion batteries. *Chemistry of Materials*, 25(17), 3480–3487. <https://doi.org/10.1021/cm401657c>
- Barpanda, P., Liu, G., Ling, C. D., Tamaru, M., Avdeev, M., Chung, S. C., Yamada, Y., & Yamada, A. (2013b). Na₂FeP₂O₇: A safe cathode for rechargeable sodium-ion batteries. *Chemistry of Materials*, 25(17), 3480–3487. <https://doi.org/10.1021/cm401657c>

-
- Barpanda, P., Lu, J., Ye, T., Kajiyama, M., Chung, S. C., Yabuuchi, N., Komaba, S., & Yamada, A. (2013). A layer-structured Na₂CoP₂O₇ pyrophosphate cathode for sodium-ion batteries. *RSC Advances*, 3(12), 3857–3860. <https://doi.org/10.1039/c3ra23026k>
- Barpanda, P., Oyama, G., Ling, C. D., & Yamada, A. (2014). Kröhnkite-type Na₂Fe(SO₄)₂·2H₂O as a novel 3.25 v insertion compound for Na-ion batteries. *Chemistry of Materials*, 26(3), 1297–1299. <https://doi.org/10.1021/cm4033226>
- Barpanda, P., Ye, T., Avdeev, M., Chung, S. C., & Yamada, A. (2013). A new polymorph of Na₂MnP₂O₇ as a 3.6 v cathode material for sodium-ion batteries. *Journal of Materials Chemistry A*, 1(13), 4194–4197. <https://doi.org/10.1039/c3ta10210f>
- Battery Market Size, Share & Trends Analysis Report*. (2019).
- Berthelot, R., Carlier, D., & Delmas, C. (2011a). Electrochemical investigation of the P₂-Na_xCoO₂ phase diagram. *Nature Materials*, 10(1), 74–80. <https://doi.org/10.1038/nmat2920>
- Berthelot, R., Carlier, D., & Delmas, C. (2011b). Electrochemical investigation of the P₂-Na_xCoO₂ phase diagram. *Nature Materials*, 10(1), 74–80. <https://doi.org/10.1038/nmat2920>
- Bi, X., Wang, R., Yuan, Y., Yuan, Y., Zhang, D., Zhang, T., Ma, L., Wu, T., Shahbazian-Yassar, R., Amine, K., Amine, K., & Lu, J. (2020). From Sodium-Oxygen to Sodium-Air Battery: Enabled by Sodium Peroxide Dihydrate. *Nano Letters*, 20(6), 4681–4686. <https://doi.org/10.1021/acs.nanolett.0c01670>
- Billaud, J., Clément, R. J., Armstrong, A. R., Canales-Vázquez, J., Rozier, P., Grey, C. P., & Bruce, P. G. (2014). β-NaMnO₂: A high-performance cathode for sodium-ion batteries. *Journal of the American Chemical Society*, 136(49), 17243–17248. <https://doi.org/10.1021/ja509704t>
- Breeze, P. (2018). Chapter 4 - Large-Scale Batteries. In P. Breeze (Ed.), *Power System Energy Storage Technologies* (pp. 33–45). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-12-812902-9.00004-3>
- Bruce, P. G., Scrosati, B., & Tarascon, J. M. (2008). Nanomaterials for rechargeable lithium batteries. In *Angewandte Chemie - International Edition* (Vol. 47, Issue 16, pp. 2930–2946). <https://doi.org/10.1002/anie.200702505>
- Buchholz, D., Chagas, L. G., Vaalma, C., Wu, L., & Passerini, S. (2014). Water sensitivity of layered P₂/P₃-Na_xNi_{0.22}Co_{0.11}Mn_{0.66}O₂ cathode material. *Journal of Materials Chemistry A*, 2(33), 13415–13421. <https://doi.org/10.1039/c4ta02627f>
-

-
- Cabana, J., Chernova, N. A., Xiao, J., Roppolo, M., Aldi, K. A., Whittingham, M. S., & Grey, C. P. (2013). Study of the transition metal ordering in layered $\text{Na}_x\text{Ni}_{1-x}/2\text{Mn}_{1-x}/2\text{O}_2$ ($2/3 \leq x \leq 1$) and consequences of Na/Li exchange. *Inorganic Chemistry*, 52(15), 8540–8550. <https://doi.org/10.1021/ic400579w>
- Cai, K., Luo, S., Cong, J., Li, K., Yan, S., Hou, P., Wang, Q., Zhang, Y., Liu, X., & Lei, X. (2022). Synthesis and Optimization of ZnMn_2O_4 Cathode Material for Zinc-Ion Battery by Citric Acid Sol-Gel Method. *Journal of The Electrochemical Society*, 169(3), 030531. <https://doi.org/10.1149/1945-7111/ac5baa>
- Cao, Y., Liu, Y., Zhao, D., Xia, X., Zhang, L., Zhang, J., Yang, H., & Xia, Y. (2020). Highly Stable $\text{Na}_3\text{Fe}_2(\text{PO}_4)_3$ @Hard Carbon Sodium-Ion Full Cell for Low-Cost Energy Storage. *ACS Sustainable Chemistry and Engineering*, 8(3), 1380–1387. <https://doi.org/10.1021/acssuschemeng.9b05098>
- Cao, Y., Xiao, L., Sushko, M. L., Wang, W., Schwenzer, B., Xiao, J., Nie, Z., Saraf, L. v., Yang, Z., & Liu, J. (2012). Sodium ion insertion in hollow carbon nanowires for battery applications. *Nano Letters*, 12(7), 3783–3787. <https://doi.org/10.1021/nl3016957>
- Chen, H., Cong, T. N., Yang, W., Tan, C., Li, Y., & Ding, Y. (2009). Progress in electrical energy storage system: A critical review. In *Progress in Natural Science* (Vol. 19, Issue 3, pp. 291–312). Science Press. <https://doi.org/10.1016/j.pnsc.2008.07.014>
- Chen, M., Liu, Q., Wang, S. W., Wang, E., Guo, X., & Chou, S. L. (2019). High-Abundance and Low-Cost Metal-Based Cathode Materials for Sodium-Ion Batteries: Problems, Progress, and Key Technologies. In *Advanced Energy Materials* (Vol. 9, Issue 14). Wiley-VCH Verlag. <https://doi.org/10.1002/aenm.201803609>
- Chen, S., Wu, C., Shen, L., Zhu, C., Huang, Y., Xi, K., Maier, J., & Yu, Y. (2017). Challenges and Perspectives for NASICON-Type Electrode Materials for Advanced Sodium-Ion Batteries. In *Advanced Materials* (Vol. 29, Issue 48). Wiley-VCH Verlag. <https://doi.org/10.1002/adma.201700431>
- Chen, X., Yang, C., Yang, Y., Ji, H., & Yang, G. (2022). Co-precipitation preparation of Ni-Co-Mn ternary cathode materials by using the sources extracting directly from spent lithium-ion batteries. *Journal of Alloys and Compounds*, 909. <https://doi.org/10.1016/j.jallcom.2022.164691>
- Chen, Y., Woo, H. J., Syed Mohd Fadzil, S. A. F., Tan, W., Wang, F., & Mohd Arof, A. K. (2022). Cage-Like Porous Prussian Blue as High-Capacity Cathode for Sodium-Ion Batteries. *ACS Applied Nano Materials*, 5(4), 4833–4840. <https://doi.org/10.1021/acsanm.1c04416>
-

-
- Chiba, K., Kijima, N., Takahashi, Y., Idemoto, Y., & Akimoto, J. (2008). Synthesis, structure, and electrochemical Li-ion intercalation properties of Li₂Ti₃O₇ with Na₂Ti₃O₇-type layered structure. *Solid State Ionics*, 178(33–34), 1725–1730. <https://doi.org/10.1016/j.ssi.2007.11.004>
- Choudhary, B., Paul, D., Singh, A., & Gupta, T. (2017). Removal of hexavalent chromium upon interaction with biochar under acidic conditions: mechanistic insights and application. *Environmental Science and Pollution Research*, 24(20), 16786–16797. <https://doi.org/10.1007/s11356-017-9322-9>
- Climate change impacts*. (n.d.).
- Cook, J. B., Kim, H. S., Lin, T. C., Robbennolt, S., Detsi, E., Dunn, B. S., & Tolbert, S. H. (2017). Tuning Porosity and Surface Area in Mesoporous Silicon for Application in Li-Ion Battery Electrodes. *ACS Applied Materials and Interfaces*, 9(22), 19063–19073. <https://doi.org/10.1021/acsami.6b16447>
- Cox, J. S. G., Woodard, G. D., & McCrone, W. C. (1971). Solid-State Chemistry of Cromolyn Sodium (Disodium Cromoglycate). *Journal of Pharmaceutical Sciences*, 60(10), 1458–1465. <https://doi.org/https://doi.org/10.1002/jps.2600601003>
- Crippa, M. G. D. S. E. F.-M. F. T. F. N. L. A. (2021). *EDGAR-FOOD emission data. figshare. Dataset*.
- Crippa, M., Solazzo, E., Guizzardi, D., van Dingenen, R., & Leip, A. (2022). Air pollutant emissions from global food systems are responsible for environmental impacts, crop losses and mortality. *Nature Food*, 3(11), 942–956. <https://doi.org/10.1038/s43016-022-00615-7>
- Cruz, I. F., Freire, C., Araújo, J. P., Pereira, C., & Pereira, A. M. (2018). Chapter 3 - Multifunctional Ferrite Nanoparticles: From Current Trends Toward the Future. In A. A. El-Gendy, J. M. Barandiarán, & R. L. Hadimani (Eds.), *Magnetic Nanostructured Materials* (pp. 59–116). Elsevier. <https://doi.org/https://doi.org/10.1016/B978-0-12-813904-2.00003-6>
- Daiyan, R., Macgill, I., & Amal, R. (2020). Opportunities and Challenges for Renewable Power-to-X. *ACS Energy Letters*, 5(12), 3843–3847. <https://doi.org/10.1021/acsenergylett.0c02249>
- Darwiche, A., Marino, C., Sougrati, M. T., Fraisse, B., Stievano, L., & Monconduit, L. (2012). Better cycling performances of bulk sb in na-ion batteries compared to li-ion systems: An unexpected electrochemical mechanism. *Journal of the American Chemical Society*, 134(51), 20805–20811. <https://doi.org/10.1021/ja310347x>
- Das, S., Dutta, D., Araujo, R. B., Chakraborty, S., Ahuja, R., & Bhattacharyya, A. J. (2016). Probing the pseudo-1-D ion diffusion in lithium titanium niobate anode
-

-
- for Li-ion battery. *Physical Chemistry Chemical Physics*, 18(32), 22323–22330. <https://doi.org/10.1039/c6cp04488c>
- Delmas, C., Braconnier, J.-J., Fouassier, C., & Hagenmuller, P. (1981a). Electrochemical intercalation of sodium in Na_xCoO_2 bronzes. *Solid State Ionics*, 3–4, 165–169. [https://doi.org/10.1016/0167-2738\(81\)90076-X](https://doi.org/10.1016/0167-2738(81)90076-X)
- Delmas, C., Braconnier, J.-J., Fouassier, C., & Hagenmuller, P. (1981b). Electrochemical intercalation of sodium in Na_xCoO_2 bronzes. *Solid State Ionics*, 3–4, 165–169. [https://doi.org/10.1016/0167-2738\(81\)90076-X](https://doi.org/10.1016/0167-2738(81)90076-X)
- Delmas, C., Fouassier, C., & Hagenmuller, P. (1980). Structural classification and properties of the layered oxides. *Physica B+C*, 99(1), 81–85. [https://doi.org/10.1016/0378-4363\(80\)90214-4](https://doi.org/10.1016/0378-4363(80)90214-4)
- Deng, C., Zhang, S., & Zhao, B. (2016). First exploration of ultrafine $\text{Na}_7\text{V}_3(\text{P}_2\text{O}_7)_4$ as a high-potential cathode material for sodium-ion battery. *Energy Storage Materials*, 4, 71–78.
- Deng, W., Feng, X., Xiao, Y., & Li, C. (2018). Layered Molybdenum (Oxy) Pyrophosphate $(\text{MoO}_2)_2\text{P}_2\text{O}_7$ as a Cathode Material for Sodium-Ion Batteries. *ChemElectroChem*, 5(7), 1032–1036. <https://doi.org/10.1002/celec.201800005>
- Drozhzhin, O. A., Tertov, I. v., Alekseeva, A. M., Akseyonov, D. A., Stevenson, K. J., Abakumov, A. M., & Antipov, E. v. (2019). $\beta\text{-NaVP}_2\text{O}_7$ as a Superior Electrode Material for Na-Ion Batteries. *Chemistry of Materials*, 31(18), 7463–7469. <https://doi.org/10.1021/acs.chemmater.9b02124>
- Du, K., Guo, H., Hu, G., Peng, Z., & Cao, Y. (2013). $\text{Na}_3\text{V}_2(\text{PO}_4)_3$ as cathode material for hybrid lithium ion batteries. *Journal of Power Sources*, 223, 284–288. <https://doi.org/10.1016/j.jpowsour.2012.09.069>
- Duffort, V., Talaie, E., Black, R., & Nazar, L. F. (2015). Uptake of CO_2 in Layered $\text{P}_2\text{-Na}_0.67\text{Mn}_0.5\text{Fe}_0.5\text{O}_2$: Insertion of carbonate anions. *Chemistry of Materials*, 27(7), 2515–2524. <https://doi.org/10.1021/acs.chemmater.5b00097>
- Dwivedi, D., Araujo, R. B., Chakraborty, S., Shanbogh, P. P., Sundaram, N. G., Ahuja, R., & Barpanda, P. (2015). $\text{Na}_{2.44}\text{Mn}_{1.79}(\text{SO}_4)_3$: a new member of the alluaudite family of insertion compounds for sodium ion batteries. *Journal of Materials Chemistry A*, 3(36), 18564–18571. <https://doi.org/10.1039/c5ta04527d>
- Eftekhari, A. (2004). Potassium secondary cell based on Prussian blue cathode. *Journal of Power Sources*, 126(1–2), 221–228. <https://doi.org/10.1016/j.jpowsour.2003.08.007>
- Eguro, T. (2014). Ni-Cadmium Batteries. In G. Kreysa, K. Ota, & R. F. Savinell (Eds.), *Encyclopedia of Applied Electrochemistry* (pp. 1358–1363). Springer New York. https://doi.org/10.1007/978-1-4419-6996-5_147
-

Electric Cars: The Battery challenge nature. Vol. 596, 336-339.

Esha Roy. (2022, August 27). To achieve net-zero emissions target by 2070, India needs \$10-tn investment from now: report. *The Indian Express*.

Essehli, R., el Bali, B., Benmokhtar, S., Fuess, H., Svoboda, I., & Obbade, S. (2010). Synthesis, crystal structure and infrared spectroscopy of a new non-centrosymmetric mixed-anion phosphate $\text{Na}_4\text{Mg}_3(\text{PO}_4)_2(\text{P}_2\text{O}_7)$. *Journal of Alloys and Compounds*, 493(1–2), 654–660. <https://doi.org/10.1016/j.jallcom.2009.12.181>

Etacheri, V., Marom, R., Elazari, R., Salitra, G., & Aurbach, D. (2011). Challenges in the development of advanced Li-ion batteries: A review. In *Energy and Environmental Science* (Vol. 4, Issue 9, pp. 3243–3262). <https://doi.org/10.1039/c1ee01598b>

Evanko, B., Boettcher, S. W., Yoo, S. J., & Stucky, G. D. (2017). Redox-Enhanced Electrochemical Capacitors: Status, Opportunity, and Best Practices for Performance Evaluation. *ACS Energy Letters*, 2(11), 2581–2590. <https://doi.org/10.1021/acseenergylett.7b00828>

Fang, Y., Yu, X. Y., & Lou, X. W. (David). (2019). Nanostructured Electrode Materials for Advanced Sodium-Ion Batteries. In *Matter* (Vol. 1, Issue 1, pp. 90–114). Cell Press. <https://doi.org/10.1016/j.matt.2019.05.007>

Feng, L., Wang, R., Zhang, Y., Ji, S., Chuan, Y., Zhang, W., Liu, B., Yuan, C., & Du, C. (2019). In situ XRD observation of CuO anode phase conversion in lithium-ion batteries. *Journal of Materials Science*, 54(2), 1520–1528. <https://doi.org/10.1007/s10853-018-2885-0>

Ferrara, C., Tealdi, C., Dall’asta, V., Buchholz, D., Chagas, L. G., Quartarone, E., Berbenni, V., & Passerini, S. (2018). High-performance na 0.44 mno 2 slabs for sodium-ion batteries obtained through urea-based solution combustion synthesis. *Batteries*, 4(1). <https://doi.org/10.3390/batteries4010008>

Fiona Harvey, I. T. (2014, January 22). EU to cut carbon emissions by 40% by 2030. *The Guardian*.

Fuentes, R. O., Figueiredo, F., Marques, F. M. B., & Franco, J. I. (n.d.). Reaction of NASICON with water. In *Solid State Ionics* (Vol. 139). www.elsevier.com/locate/ssi

Galceran, M., Saurel, D., Acebedo, B., Roddatis, V. v., Martin, E., Rojo, T., & Casas-Cabanas, M. (2014). The mechanism of NaFePO_4 (de)sodiation determined by in situ X-ray diffraction. *Physical Chemistry Chemical Physics*, 16(19), 8837–8842. <https://doi.org/10.1039/c4cp01089b>

-
- Gao, C., Zhou, J., Liu, G., & Wang, L. (2018). Lithium-ions diffusion kinetic in LiFePO₄ /carbon nanoparticles synthesized by microwave plasma chemical vapor deposition for lithium-ion batteries. *Applied Surface Science*, 433, 35–44. <https://doi.org/10.1016/j.apsusc.2017.10.034>
- Gao, H., Xin, S., Xue, L., & Goodenough, J. B. (2018). Stabilizing a High-Energy-Density Rechargeable Sodium Battery with a Solid Electrolyte. *Chem*, 4(4), 833–844. <https://doi.org/10.1016/j.chempr.2018.01.007>
- Ge, Y., Zhu, J., Lu, Y., Chen, C., Qiu, Y., & Zhang, X. (2015). The study on structure and electrochemical sodiation of one-dimensional nanocrystalline TiO₂@C nanofiber composites. *Electrochimica Acta*, 176, 989–996. <https://doi.org/10.1016/j.electacta.2015.07.105>
- Global Energy Perspective 2022*. (2022). <https://www.mckinsey.com/media/McKinsey/Industries/OilandGas>
- Goodenough, J. B., & Braga, M. H. (2018a). Batteries for electric road vehicles. *Dalton Transactions*, 47(3), 645–648. <https://doi.org/10.1039/c7dt03026f>
- Goodenough, J. B., & Braga, M. H. (2018b). Batteries for electric road vehicles. *Dalton Transactions*, 47(3), 645–648. <https://doi.org/10.1039/c7dt03026f>
- Goodenough, J. B., Hong, H. Y.-P., & Kafalas, J. A. (1976). Fast Na⁺-ion transport in skeleton structures. *Materials Research Bulletin*, 11(2), 203–220. [https://doi.org/https://doi.org/10.1016/0025-5408\(76\)90077-5](https://doi.org/https://doi.org/10.1016/0025-5408(76)90077-5)
- Goodenough, J. B., & Park, K. S. (2013). The Li-ion rechargeable battery: A perspective. In *Journal of the American Chemical Society* (Vol. 135, Issue 4, pp. 1167–1176). <https://doi.org/10.1021/ja3091438>
- Govindaraj, G., & Mariappan, C. R. (n.d.). PACS: 66.30 Hs; 77.22 Ch. www.elsevier.com/locate/ssi
- Greenhouse Gas Emissions from Energy Data Explorer*. (2021).
- Grid-Scale Storage*. (2022).
- Gu, Z. Y., Guo, J. Z., Sun, Z. H., Zhao, X. X., Wang, X. T., Liang, H. J., Wu, X. L., & Liu, Y. (2021). Air/water/temperature-stable cathode for all-climate sodium-ion batteries. *Cell Reports Physical Science*, 2(12). <https://doi.org/10.1016/j.xcrp.2021.100665>
- Guo, S., Liu, P., Yu, H., Zhu, Y., Chen, M., Ishida, M., & Zhou, H. (2015). A Layered P2- and O3-Type Composite as a High-Energy Cathode for Rechargeable Sodium-Ion Batteries. *Angewandte Chemie*, 127(20), 5992–5997. <https://doi.org/10.1002/ange.201411788>
-

-
- Gupta, A., Buddie Mullins, C., & Goodenough, J. B. (2013a). Na₂Ni₂TeO₆: Evaluation as a cathode for sodium battery. *Journal of Power Sources*, 243, 817–821. <https://doi.org/10.1016/j.jpowsour.2013.06.073>
- Hawley Oak Ridge TN (United States); Univ. of Tennessee Knoxville TN (United States)], W. [Oak R. N. Lab. (ORNL), & Li Oak Ridge TN (United States); Univ. of Tennessee Knoxville TN (United States)] (ORCID:0000000287109847), J. [Oak R. N. Lab. (ORNL). (2019). *Electrode manufacturing for lithium-ion batteries—Analysis of current and next generation processing*. 25. <https://doi.org/https://doi.org/10.1016/j.est.2019.100862>
- He, K., Lin, F., Zhu, Y., Yu, X., Li, J., Lin, R., Nordlund, D., Weng, T.-C., Richards, R. M., Yang, X.-Q., Doeff, M. M., Stach, E. A., Mo, Y., Xin, H. L., & Su, D. (2015). Sodiation Kinetics of Metal Oxide Conversion Electrodes: A Comparative Study with Lithiation. *Nano Letters*, 15(9), 5755–5763. <https://doi.org/10.1021/acs.nanolett.5b01709>
- Hirsh, H. S., Li, Y., Tan, D. H. S., Zhang, M., Zhao, E., & Meng, Y. S. (2020). Sodium-Ion Batteries Paving the Way for Grid Energy Storage. *Advanced Energy Materials*, 10(32). <https://doi.org/10.1002/aenm.202001274>
- Hong, C., Leng, Q., Zhu, J., Zheng, S., He, H., Li, Y., Liu, R., Wan, J., & Yang, Y. (2020). Revealing the correlation between structural evolution and Li⁺-diffusion kinetics of nickel-rich cathode materials in Li-ion batteries. *Journal of Materials Chemistry A*, 8(17), 8540–8547. <https://doi.org/10.1039/d0ta00555j>
- Hong, Z., Zhen, Y., Ruan, Y., Kang, M., Zhou, K., Zhang, J. M., Huang, Z., & Wei, M. (2018). Rational Design and General Synthesis of S-Doped Hard Carbon with Tunable Doping Sites toward Excellent Na-Ion Storage Performance. *Advanced Materials*, 30(29). <https://doi.org/10.1002/adma.201802035>
- Huang, X., Ma, J., Wu, P., Hu, Y., Dai, J., Zhu, Z., Chen, H., & Wang, H. (2005). Hydrothermal synthesis of LiCoPO₄ cathode materials for rechargeable lithium ion batteries. *Materials Letters*, 59(5), 578–582. <https://doi.org/10.1016/j.matlet.2004.10.049>
- Hui (Claire) Xiong, E. J. D. K. L. G. (2018). *Comprehensive Energy Systems* (Ibrahim Dincer, Ed.; 2.20 Batteries, Vol. 1). Elsevier.
- Huie, M. M., Bock, D. C., Takeuchi, E. S., Marschilok, A. C., & Takeuchi, K. J. (2015). Cathode materials for magnesium and magnesium-ion based batteries. In *Coordination Chemistry Reviews* (Vol. 287, pp. 15–27). Elsevier. <https://doi.org/10.1016/j.ccr.2014.11.005>
- Hunt, N. D., Liebman, M., Thakrar, S. K., & Hill, J. D. (2020). Fossil Energy Use, Climate Change Impacts, and Air Quality-Related Human Health Damages of Conventional and Diversified Cropping Systems in Iowa, USA. *Environmental*
-

Science and Technology, 54(18), 11002–11014.
<https://doi.org/10.1021/acs.est.9b06929>

Hussain, H. M., Javaid, N., Iqbal, S., Ul Hasan, Q., Aurangzeb, K., & Alhussein, M. (2018). An efficient demand side management system with a new optimized home energy management controller in smart grid. *Energies*, 11(1).
<https://doi.org/10.3390/en11010190>

Hwang, J. Y., Myung, S. T., & Sun, Y. K. (2017). Sodium-ion batteries: Present and future. In *Chemical Society Reviews* (Vol. 46, Issue 12, pp. 3529–3614). Royal Society of Chemistry. <https://doi.org/10.1039/c6cs00776g>

India Energy Outlook 2021. (n.d.).

Investigation of Solar Water Heating System with Phase Change Materials. (n.d.).
www.ijert.org

Jache, B., & Adelhelm, P. (2014). Use of Graphite as a Highly Reversible Electrode with Superior Cycle Life for Sodium-Ion Batteries by Making Use of Co-Intercalation Phenomena. *Angewandte Chemie*, 126(38), 10333–10337.
<https://doi.org/10.1002/ange.201403734>

James Abraham, J., Arro, C. R. A., Tariq, H. A., Kahraman, R., Al-Qaradawi, S., al tahtamouni, T. M., & Shakoor, R. A. (2021). Sodium and lithium incorporated cathode materials for energy storage applications - A focused review. In *Journal of Power Sources* (Vol. 506). Elsevier B.V.
<https://doi.org/10.1016/j.jpowsour.2021.230098>

Jason Svarc. (2020, October 30). *Solar Battery System Types - AC Vs DC Coupled*.
Cleanenergyreviews.

Jian, Z., Hu, Y. S., Ji, X., & Chen, W. (2017a). NASICON-Structured Materials for Energy Storage. In *Advanced Materials* (Vol. 29, Issue 20). Wiley-VCH Verlag.
<https://doi.org/10.1002/adma.201601925>

Jian, Z., Luo, W., & Ji, X. (2015). Carbon Electrodes for K-Ion Batteries. *Journal of the American Chemical Society*, 137(36), 11566–11569.
<https://doi.org/10.1021/jacs.5b06809>

Kabbour, H., Coillot, D., Colmont, M., Masquelier, C., & Mentré, O. (2011). α - $\text{Na}_3\text{M}_2(\text{PO}_4)_3$ (M = Ti, Fe): Absolute cationic ordering in NASICON-type phases. *Journal of the American Chemical Society*, 133(31), 11900–11903.
<https://doi.org/10.1021/ja204321y>

Kawai, K., Asakura, D., Nishimura, S. ichi, & Yamada, A. (2019). Stabilization of a 4.5 V $\text{Cr}^{4+}/\text{Cr}^{3+}$ redox reaction in NASICON-type $\text{Na}_3\text{Cr}_2(\text{PO}_4)_3$ by Ti substitution. *Chemical Communications*, 55(91), 13717–13720.
<https://doi.org/10.1039/c9cc04860j>

-
- Kim, E. J., Kumar, P. R., Gossage, Z. T., Kubota, K., Hosaka, T., Tatara, R., & Komaba, S. (2022). Active material and interphase structures governing performance in sodium and potassium ion batteries. In *Chemical Science* (Vol. 13, Issue 21, pp. 6121–6158). Royal Society of Chemistry. <https://doi.org/10.1039/d2sc00946c>
- Kim, S. W., Seo, D. H., Ma, X., Ceder, G., & Kang, K. (2012). Electrode materials for rechargeable sodium-ion batteries: Potential alternatives to current lithium-ion batteries. In *Advanced Energy Materials* (Vol. 2, Issue 7, pp. 710–721). <https://doi.org/10.1002/aenm.201200026>
- Klein, F., Jache, B., Bhide, A., & Adelhelm, P. (2013). Conversion reactions for sodium-ion batteries. *Physical Chemistry Chemical Physics*, *15*(38), 15876–15887. <https://doi.org/10.1039/c3cp52125g>
- Komaba, S., Yabuuchi, N., Nakayama, T., Ogata, A., Ishikawa, T., & Nakai, I. (2012). Study on the reversible electrode reaction of $\text{Na}_{1-x}\text{Ni}_{0.5}\text{Mn}_{0.5}\text{O}_2$ for a rechargeable sodium-ion battery. *Inorganic Chemistry*, *51*(11), 6211–6220. <https://doi.org/10.1021/ic300357d>
- Kosova, N. v., & Belotserkovsky, V. A. (2018). Sodium and mixed sodium/lithium iron ortho-pyrophosphates: Synthesis, structure and electrochemical properties. *Electrochimica Acta*, *278*, 182–195. <https://doi.org/10.1016/j.electacta.2018.05.034>
- Kumar, A., Kumar, S., Jana, S., Rajpal, & Prakash, R. (2022). Facile Polypyrrole/NASICON (PPy/ $\text{Na}_3\text{Fe}_2(\text{SO}_4)_2(\text{PO}_4)$) Electrode Materials for the Hydrogen Evolution Reaction. *Energy and Fuels*, *36*(18), 11142–11153. <https://doi.org/10.1021/acs.energyfuels.2c01893>
- Kumar, S., Mondal, R., Prakash, R., & Singh, P. (2022). Eldfellite-structured $\text{NaCr}(\text{SO}_4)_2$: a potential anode for rechargeable Na-ion and Li-ion batteries. *Dalton Transactions*, *51*(31), 11823–11833. <https://doi.org/10.1039/d2dt00573e>
- Kumar, S., Ranjeeth, R., Mishra, N. K., Prakash, R., & Singh, P. (2022a). NASICON-structured $\text{Na}_3\text{Fe}_2\text{PO}_4(\text{SO}_4)_2$: a potential cathode material for rechargeable sodium-ion batteries. *Dalton Transactions*, *51*(15), 5834–5840. <https://doi.org/10.1039/d2dt00780k>
- Kundu, D., Talaie, E., Duffort, V., & Nazar, L. F. (2015). The emerging chemistry of sodium ion batteries for electrochemical energy storage. In *Angewandte Chemie - International Edition* (Vol. 54, Issue 11, pp. 3432–3448). Wiley-VCH Verlag. <https://doi.org/10.1002/anie.201410376>
- Kurzweil, P. (2010). Gaston Planté and his invention of the lead-acid battery-The genesis of the first practical rechargeable battery. *Journal of Power Sources*, *195*(14), 4424–4434. <https://doi.org/10.1016/j.jpowsour.2009.12.126>
-

-
- Ledain, S., Leclaire, A., Borel, M. M., & Raveau, B. (1996). A New Mixed Valent Molybdenum Monophosphate with a Tunnel Structure: $\text{Li}_x\text{Mo}_2\text{O}_3(\text{PO}_4)_2$. In *JOURNAL OF SOLID STATE CHEMISTRY* (Vol. 122).
- Li, S. F., Gu, Z. Y., Guo, J. Z., Hou, X. K., Yang, X., Zhao, B., & Wu, X. L. (2021). Enhanced electrode kinetics and electrochemical properties of low-cost $\text{NaFe}_2\text{PO}_4(\text{SO}_4)_2$ via Ca^{2+} doping as cathode material for sodium-ion batteries. *Journal of Materials Science and Technology*, 78, 176–182. <https://doi.org/10.1016/j.jmst.2020.10.047>
- Li, S. F., Hou, X. K., Gu, Z. Y., Meng, Y. F., Zhao, C. de, Zhang, H. X., & Wu, X. L. (2021). Sponge-like $\text{NaFe}_2\text{PO}_4(\text{SO}_4)_2@r\text{GO}$ as a high-performance cathode material for sodium-ion batteries. *New Journal of Chemistry*, 45(10), 4854–4859. <https://doi.org/10.1039/d1nj00262g>
- Liang, Y., Zhao, C. Z., Yuan, H., Chen, Y., Zhang, W., Huang, J. Q., Yu, D., Liu, Y., Titirici, M. M., Chueh, Y. L., Yu, H., & Zhang, Q. (2019). A review of rechargeable batteries for portable electronic devices. In *InfoMat* (Vol. 1, Issue 1, pp. 6–32). Blackwell Publishing Ltd. <https://doi.org/10.1002/inf2.12000>
- Liao, Y., Singh, P., Park, K. S., Li, W., & Goodenough, J. B. (2013). $\text{Li}_6\text{Zr}_2\text{O}_7$ interstitial lithium-ion solid electrolyte. *Electrochimica Acta*, 102, 446–450. <https://doi.org/10.1016/j.electacta.2013.04.029>
- Lim, S. Y., Kim, H., Shakoor, R. A., Jung, Y., & Choi, J. W. (2012). Electrochemical and Thermal Properties of NASICON Structured $\text{Na}_3\text{V}_2(\text{PO}_4)_3$ as a Sodium Rechargeable Battery Cathode: A Combined Experimental and Theoretical Study. *Journal of The Electrochemical Society*, 159(9), A1393. <https://doi.org/10.1149/2.015209jes>
- Lister, S. E., Rixom, V. J., & Evans, J. S. O. (2010a). Structural and mechanistic studies of the dehydration of $\text{MoO}_2\text{P}_2\text{O}_7 \cdot \text{H}_2\text{O}$ and the in situ identification of two new molybdenum phosphates. *Chemistry of Materials*, 22(18), 5279–5289. <https://doi.org/10.1021/cm101429u>
- Lister, S. E., Solellhavoup, A., Withers, R. L., Hodgkinson, P., & Evans, J. S. O. (2010). Structures and phase transitions in $(\text{MoO}_2)_2\text{P}_2\text{O}_7$. *Inorganic Chemistry*, 49(5), 2290–2301. <https://doi.org/10.1021/ic902166j>
- Liu, J., Kong, W., Zhou, T., Chen, L., Wang, Y., Peterson, V. K., Yang, Z., Guo, Z., & Xia, Y. (2017). $\text{Li}_2\text{Ti}_2\text{SiO}_5$: A Low Redox Potential and Large Capacity Titanium-Based Anode Material for Lithium-Ion Batteries.
- Liu, Q., Hu, Z., Zou, C., Jin, H., Wang, S., & Li, L. (2021). Structural engineering of electrode materials to boost high-performance sodium-ion batteries. In *Cell Reports Physical Science* (Vol. 2, Issue 9). Cell Press. <https://doi.org/10.1016/j.xcrp.2021.100551>
-

-
- Liu, S., Yan, P., Li, H., Zhang, X., & Sun, W. (2020). One-Step Microwave Synthesis of Micro/Nanoscale LiFePO₄/Graphene Cathode With High Performance for Lithium-Ion Batteries. *Frontiers in Chemistry*, 8. <https://doi.org/10.3389/fchem.2020.00104>
- Liu, Y., Merinov, B. v., & Goddard, W. A. (2016). Origin of low sodium capacity in graphite and generally weak substrate binding of Na and Mg among alkali and alkaline earth metals. *Proceedings of the National Academy of Sciences of the United States of America*, 113(14), 3735–3739. <https://doi.org/10.1073/pnas.1602473113>
- Lu, X., Xia, G., Lemmon, J. P., & Yang, Z. (2010). Advanced materials for sodium-beta alumina batteries: Status, challenges and perspectives. In *Journal of Power Sources* (Vol. 195, Issue 9, pp. 2431–2442). <https://doi.org/10.1016/j.jpowsour.2009.11.120>
- Ma, C., Fu, Z., Deng, C., Liao, X. Z., He, Y. S., Ma, Z. F., & Xiong, H. (2018). Carbon-coated FeP nanoparticles anchored on carbon nanotube networks as an anode for long-life sodium-ion storage. *Chemical Communications*, 54(80), 11348–11351. <https://doi.org/10.1039/C8CC06291A>
- Makula, P., Pacia, M., & Macyk, W. (2018). How To Correctly Determine the Band Gap Energy of Modified Semiconductor Photocatalysts Based on UV-Vis Spectra. In *Journal of Physical Chemistry Letters* (Vol. 9, Issue 23, pp. 6814–6817). American Chemical Society. <https://doi.org/10.1021/acs.jpcllett.8b02892>
- Manthiram, A. (2017). An Outlook on Lithium Ion Battery Technology. *ACS Central Science*, 3(10), 1063–1069. <https://doi.org/10.1021/acscentsci.7b00288>
- Manthiram, A. (2020). A reflection on lithium-ion battery cathode chemistry. In *Nature Communications* (Vol. 11, Issue 1). Nature Research. <https://doi.org/10.1038/s41467-020-15355-0>
- Manthiram, A., & Goodenough, J. B. (1989). LITHIUM INSERTION INTO Fe₂(S₀& FRAMEWORKS. In *Journal of Power Sources* (Vol. 26).
- Materials for sustainable energy*. Nature Vol 16, 2016(n.d.).
- Matt Pressman. (2017, August 6). *UNDERSTANDING TESLA'S LITHIUM ION BATTERIES*.
- Meng, Q., Lu, Y., Ding, F., Zhang, Q., Chen, L., & Hu, Y. S. (2019). Tuning the Closed Pore Structure of Hard Carbons with the Highest Na Storage Capacity. *ACS Energy Letters*, 4(11), 2608–2612. <https://doi.org/10.1021/acsenenergylett.9b01900>
- Meng, Y., Yu, T., Zhang, S., & Deng, C. (2016). Top-down synthesis of muscle-inspired alluaudite Na_{2+2x}Fe_{2-x}(SO₄)₃/SWNT spindle as a high-rate and high-
-

-
- potential cathode for sodium-ion batteries. *Journal of Materials Chemistry A*, 4(5), 1624–1631. <https://doi.org/10.1039/c5ta07696j>
- Meyer, C., Bockholt, H., Haselrieder, W., & Kwade, A. (2017). Characterization of the calendaring process for compaction of electrodes for lithium-ion batteries. *Journal of Materials Processing Technology*, 249, 172–178. <https://doi.org/10.1016/j.jmatprotec.2017.05.031>
- Mizushima, K., Jones, P. C., Wiseman, P. J., & Goodenough, J. B. (1980). Li_xCoO_2 ($0 < x < 1$): A new cathode material for batteries of high energy density. *Materials Research Bulletin*, 15(6), 783–789. [https://doi.org/https://doi.org/10.1016/0025-5408\(80\)90012-4](https://doi.org/https://doi.org/10.1016/0025-5408(80)90012-4)
- Mochane, M. J., Mokhena, T. C., Mokhothu, T. H., Mtibe, A., Sadiku, E. R., & Ray, S. S. (2018). Chapter 42 - The Importance of Nanostructured Materials for Energy Storage/Conversion. In C. Mustansar Hussain (Ed.), *Handbook of Nanomaterials for Industrial Applications* (pp. 768–792). Elsevier. <https://doi.org/https://doi.org/10.1016/B978-0-12-813351-4.00044-4>
- Moreau, P., Guyomard, D., Gaubicher, J., & Boucher, F. (2010). Structure and stability of sodium intercalated phases in olivine FePO_4 . *Chemistry of Materials*, 22(14), 4126–4128. <https://doi.org/10.1021/cm101377h>
- Ni, Q., Bai, Y., Wu, F., & Wu, C. (2017). Polyanion-type electrode materials for sodium-ion batteries. *Advanced Science*, 4(3). <https://doi.org/10.1002/advs.201600275>
- Nickol, A., Schied, T., Heubner, C., Schneider, M., Michaelis, A., Bobeth, M., & Cuniberti, G. (2020). GITT Analysis of Lithium Insertion Cathodes for Determining the Lithium Diffusion Coefficient at Low Temperature: Challenges and Pitfalls. *Journal of The Electrochemical Society*, 167(9), 090546. <https://doi.org/10.1149/1945-7111/ab9404>
- Nisar, U., Gulied, M. H., Shakoor, R. A., Essehli, R., Ahmad, Z., Alashraf, A., Kahraman, R., Al-Qaradawi, S., & Soliman, A. (2018a). Synthesis and performance evaluation of nanostructured $\text{NaFe}_x\text{Cr}_{1-x}(\text{SO}_4)_2$ cathode materials in sodium ion batteries (SIBs). *RSC Advances*, 8(57), 32985–32991. <https://doi.org/10.1039/c8ra06583g>
- Nitta, N., Wu, F., Lee, J. T., & Yushin, G. (2015). Li-ion battery materials: Present and future. In *Materials Today* (Vol. 18, Issue 5, pp. 252–264). Elsevier B.V. <https://doi.org/10.1016/j.mattod.2014.10.040>
- Niu, Y., Shang, D., & Li, Z. (2022). Micro/Nano Energy Storage Devices Based on Composite Electrode Materials. *Nanomaterials*, 12(13). <https://doi.org/10.3390/nano12132202>
-

-
- Niu, Y., Zhang, Y., & Xu, M. (2019). A review on pyrophosphate framework cathode materials for sodium-ion batteries. In *Journal of Materials Chemistry A* (Vol. 7, Issue 25, pp. 15006–15025). Royal Society of Chemistry. <https://doi.org/10.1039/c9ta04274a>
- Nurohmah, A. R., Nisa, S. S., Stulasti, K. N. R., Yudha, C. S., Suci, W. G., Aliwarga, K., Widiyandari, H., & Purwanto, A. (2022). Sodium-ion battery from sea salt: a review. In *Materials for Renewable and Sustainable Energy* (Vol. 11, Issue 1, pp. 71–89). Springer Science and Business Media Deutschland GmbH. <https://doi.org/10.1007/s40243-022-00208-1>
- Oka, N. O. (2019). *SUSTAINABLE DEVELOPMENT: 2015 CLIMATE CHANGE AGREEMENT AND NIGERIA'S COMMITMENT TO ITS NATIONALLY DETERMINED CONTRIBUTIONS*. 11(1). <https://doi.org/10.2478/msd-2019-0015>
- Ouyang, L., Wu, Z., Wang, J., Qi, X., Li, Q., Wang, J., & Lu, S. (2020). The effect of solid content on the rheological properties and microstructures of a Li-ion battery cathode slurry. *RSC Advances*, 10(33), 19360–19370. <https://doi.org/10.1039/d0ra02651d>
- Padhi, A. K., Nanjundaswamy, K. S., & Goodenough, J. B. (1997). 12. 5. Picart and E. Genies. In *16. E. M. Genies and S. Picart, Synth. Met* (Vol. 144, Issue 4). John Wiley & Sons, Inc.
- Padhi, A. K., Nanjundaswamy, K. S., Masquelier, C., & Goodenough, J. B. (1997). Mapping of Transition Metal Redox Energies in Phosphates with NASICON Structure by Lithium Intercalation. *Journal of The Electrochemical Society*, 144(8), 2581. <https://doi.org/10.1149/1.1837868>
- Palomares, V., Casas-Cabanas, M., Castillo-Martínez, E., Han, M. H., & Rojo, T. (2013). Update on Na-based battery materials. A growing research path. In *Energy and Environmental Science* (Vol. 6, Issue 8, pp. 2312–2337). <https://doi.org/10.1039/c3ee41031e>
- Pan, C. J., Yuan, C., Zhu, G., Zhang, Q., Huang, C. J., Lin, M. C., Angell, M., Hwang, B. J., Kaghazchi, P., & Dai, H. (2018). An operando X-ray diffraction study of chloroaluminate anion-graphite intercalation in aluminum batteries. *Proceedings of the National Academy of Sciences of the United States of America*, 115(22), 5670–5675. <https://doi.org/10.1073/pnas.1803576115>
- Pan, H., Hu, Y. S., & Chen, L. (2013). Room-temperature stationary sodium-ion batteries for large-scale electric energy storage. In *Energy and Environmental Science* (Vol. 6, Issue 8, pp. 2338–2360). <https://doi.org/10.1039/c3ee40847g>

-
- Pandey, P. C., & Prakash, R. (1998). Electrochemical Synthesis of Polyindole and Its Evaluation for Rechargeable Battery Applications. *Journal of The Electrochemical Society*, 145(3), 999. <https://doi.org/10.1149/1.1838377>
- Pang, H., Cheng, P., Yang, H., Lu, J., Xian Guo, C., Ning, G., & Ming Li, C. (2013). Template-free bottom-up synthesis of yolk-shell vanadium oxide as high performance cathode for lithium ion batteries. *Chemical Communications*, 49(15), 1536–1538. <https://doi.org/10.1039/c2cc38244j>
- Park, J. H., Yoon, H., Cho, Y., & Yoo, C. Y. (2021). Investigation of lithium ion diffusion of graphite anode by the galvanostatic intermittent titration technique. *Materials*, 14(16). <https://doi.org/10.3390/ma14164683>
- Paul Breeze. (2019). Power system energy storage technologies. In Breeze Paul (Ed.), *Power Generation Technologies* (3rd ed., pp. 219–249). Elsevier.
- Pavia, D. L. , L. G. M. , K. G. S. , & V. J. R. (2015). *Introduction to spectroscopy* (Third). Cengage Learning.
- Peljo, P., & Girault, H. H. (2018). Electrochemical potential window of battery electrolytes: The HOMO-LUMO misconception. *Energy and Environmental Science*, 11(9), 2306–2309. <https://doi.org/10.1039/c8ee01286e>
- Peter, S. C. (2018). Reduction of CO₂ to Chemicals and Fuels: A Solution to Global Warming and Energy Crisis. In *ACS Energy Letters* (Vol. 3, Issue 7, pp. 1557–1561). American Chemical Society. <https://doi.org/10.1021/acsenerylett.8b00878>
- Ponrouch, A., Monti, D., Boschini, A., Steen, B., Johansson, P., & Palacín, M. R. (2015). Non-aqueous electrolytes for sodium-ion batteries. In *Journal of Materials Chemistry A* (Vol. 3, Issue 1, pp. 22–42). Royal Society of Chemistry. <https://doi.org/10.1039/c4ta04428b>
- Prakash, A. S., Manikandan, P., Ramesha, K., Sathiya, M., Tarascon, J. M., & Shukla, A. K. (2010). Solution-combustion synthesized nanocrystalline Li₄Ti₅O₁₂ as high-rate performance li-ion battery anode. *Chemistry of Materials*, 22(9), 2857–2863. <https://doi.org/10.1021/cm100071z>
- Pr³⁺ doped BaNb₂O₆ reddish orange emitting phosphor for solid state lighting and optical thermometry applications – Elsevier Enhanced Reader.* <https://doi.org/10.1016/j.jallcom.2019.153342>
- Qian, J., Wu, X., Cao, Y., Ai, X., & Yang, H. (2013). High capacity and rate capability of amorphous phosphorus for sodium ion batteries. *Angewandte Chemie - International Edition*, 52(17), 4633–4636. <https://doi.org/10.1002/anie.201209689>
-

-
- Qiu, S., Wu, X., Wang, M., Lucero, M., Wang, Y., Wang, J., Yang, Z., Xu, W., Wang, Q., Gu, M., Wen, J., Huang, Y., Xu, Z. J., & Feng, Z. (2019). NASICON-type $\text{Na}_3\text{Fe}_2(\text{PO}_4)_3$ as a low-cost and high-rate anode material for aqueous sodium-ion batteries. *Nano Energy*, *64*. <https://doi.org/10.1016/j.nanoen.2019.103941>
- Ramaswamy, V., Vimalathithan, R. M., & Ponnusamy, V. (2010a). Synthesis and characterization of BaSO_4 nano particles using micro emulsion technique. *Pelagia Research Library Advances in Applied Science Research*, *1*(3), 197–204. www.pelagiaresearchlibrary.com
- Rao, Y. B., Bharathi, K. K., & Patro, L. N. (2021). Review on the synthesis and doping strategies in enhancing the Na ion conductivity of $\text{Na}_3\text{Zr}_2\text{Si}_2\text{PO}_{12}$ (NASICON) based solid electrolytes. *Solid State Ionics*, 366–367. <https://doi.org/10.1016/j.ssi.2021.115671>
- Raphael G. Raptis, John P Fackler, *Intercalation in linear chain compound $\text{MoO}_2\text{HPO}_4 \cdot \text{H}_2\text{O}$* . *inorg.chem.* 1989, 28, 4059-4061
- S. Ledain, A. Leclaire, M.M Borel, *A Mixed-Valence Molybdenum Monophosphate with a Three-Dimensional Framework_ $\text{LiMo}_2\text{O}_3(\text{PO}_4)_2$* _Elsevier Enhanced Reader. (n.d.).
- Saba, N., & Jawaid, M. (2018). 4 - Energy and environmental applications of graphene and its derivatives. In M. Jawaid & M. M. Khan (Eds.), *Polymer-based Nanocomposites for Energy and Environmental Applications* (pp. 105–129). Woodhead Publishing. <https://doi.org/https://doi.org/10.1016/B978-0-08-102262-7.00004-0>
- Saracibar, A., Carrasco, J., Saurel, D., Galceran, M., Acebedo, B., Anne, H., Lepoitevin, M., Rojo, T., & Casas Cabanas, M. (2016). Investigation of sodium insertion-extraction in olivine Na_xFePO_4 ($0 \leq x \leq 1$) using first-principles calculations. *Physical Chemistry Chemical Physics*, *18*(18), 13045–13051. <https://doi.org/10.1039/c6cp00762g>
- Sawicki, M., & Shaw, L. L. (2015). Advances and challenges of sodium ion batteries as post lithium ion batteries. *RSC Advances*, *5*(65), 53129–53154. <https://doi.org/10.1039/c5ra08321d>
- Schmidt, D. G. (2016). Research Opportunities for Future Energy Technologies. In *ACS Energy Letters* (Vol. 1, Issue 1, pp. 244–245). American Chemical Society. <https://doi.org/10.1021/acsenergylett.6b00193>
- Shannon, R. D. (1976). Revised effective ionic radii and systematic studies of interatomic distances in halides and chalcogenides. *Acta Crystallographica Section A*, *32*(5), 751–767. <https://doi.org/10.1107/S0567739476001551>
-

-
- Shen, B., Xu, M., Niu, Y., Han, J., Lu, S., Jiang, J., Li, Y., Dai, C., Hu, L., & Li, C. (2018). Sodium-Rich Ferric Pyrophosphate Cathode for Stationary Room-Temperature Sodium-Ion Batteries. *ACS Applied Materials and Interfaces*, *10*(1), 502–508. <https://doi.org/10.1021/acsami.7b13516>
- Shen, Y., Li, C., Zhu, X., Xie, A., Qiu, L., & Zhu, J. (2007). Study on the preparation and formation mechanism of barium sulphate nanoparticles modified by different organic acids. In *J. Chem. Sci* (Vol. 119, Issue 4).
- Shishkin, M., & Sato, H. (2017). Ab Initio Study of Stability of Na₂Fe₂(SO₄)₃, a High Potential Na-Ion Battery Cathode Material. *Journal of Physical Chemistry C*, *121*(37), 20067–20074. <https://doi.org/10.1021/acs.jpcc.7b02479>
- Shiva, K., Singh, P., Zhou, W., & Goodenough, J. B. (2016a). NaFe₂PO₄(SO₄)₂: A potential cathode for a Na-ion battery. *Energy and Environmental Science*, *9*(10), 3103–3106. <https://doi.org/10.1039/c6ee01093h>
- Singh, P., Shiva, K., Celio, H., & Goodenough, J. B. (2015a). Eldfellite, NaFe(SO₄)₂: an intercalation cathode host for low-cost Na-ion batteries. *Energy and Environmental Science*, *8*(10), 3000–3005. <https://doi.org/10.1039/c5ee02274f>
- Sodium-Ion Battery Market*. (2022).
- Sodium-Ion Batteries Self-Supporting Flexible Additive-Free and Scalable Hard Carbon*. Vol 31, 40, 4, 2019 (n.d.).
- Song, J., Yu, Z., Gordin, M. L., Hu, S., Yi, R., Tang, D., Walter, T., Regula, M., Choi, D., Li, X., Manivannan, A., & Wang, D. (2014). Chemically bonded phosphorus/graphene hybrid as a high performance anode for sodium-ion batteries. *Nano Letters*, *14*(11), 6329–6335. <https://doi.org/10.1021/nl502759z>
- Souza, R., Navarro, R., Grillo, A. V., & Brocchi, E. (2019). Potassium alum thermal decomposition study under non-reductive and reductive conditions. *Journal of Materials Research and Technology*, *8*(1), 745–751. <https://doi.org/10.1016/j.jmrt.2018.05.017>
- Stevens, D. A., & Dahn, J. R. (2001). The Mechanisms of Lithium and Sodium Insertion in Carbon Materials. *Journal of The Electrochemical Society*, *148*(8), A803. <https://doi.org/10.1149/1.1379565>
- Sun, B., Xiong, P., Maitra, U., Langsdorf, D., Yan, K., Wang, C., Janek, J., Schröder, D., & Wang, G. (2020). Design Strategies to Enable the Efficient Use of Sodium Metal Anodes in High-Energy Batteries. *Advanced Materials*, *32*(18). <https://doi.org/10.1002/adma.201903891>
- Sun, Y., Lu, P., Liang, X., Chen, C., & Xiang, H. (2019). High-yield microstructure-controlled amorphous carbon anode materials through a pre-oxidation strategy for
-

-
- sodium ion batteries. *Journal of Alloys and Compounds*, 786, 468–474. <https://doi.org/10.1016/j.jallcom.2019.01.388>
- Tarascon, J. M. (2010a). Is lithium the new gold? In *Nature Chemistry* (Vol. 2, Issue 6, p. 510). <https://doi.org/10.1038/nchem.680>
- Tian, Z., Zou, Y., Liu, G., Wang, Y., Yin, J., Ming, J., & Alshareef, H. N. (2022). Electrolyte Solvation Structure Design for Sodium Ion Batteries. In *Advanced Science* (Vol. 9, Issue 22). John Wiley and Sons Inc. <https://doi.org/10.1002/advs.202201207>
- Tizzoni, A. C., Corsaro, N., D'Ottavi, C., Licoccia, S., Sau, S., & Tarquini, P. (2015). Oxygen production by intermediate metal sulphates in sulphur based thermochemical water splitting cycles. *International Journal of Hydrogen Energy*, 40(11), 4065–4083. <https://doi.org/10.1016/j.ijhydene.2015.01.147>
- Tournadre, F., Croguennec, L., Willmann, P., & Delmas, C. (2004). On the mechanism of the $\text{P2-Na}_{0.70}\text{CoO}_2 \rightarrow \text{O2-LiCoO}_2$ exchange reaction - Part II: An in situ X-ray diffraction study. *Journal of Solid State Chemistry*, 177(8), 2803–2809. <https://doi.org/10.1016/j.jssc.2004.04.028>
- Trad, K., Carlier, D., Croguennec, L., Wattiaux, A., ben Amara, M., & Delmas, C. (2010). $\text{NaMnFe}_2(\text{PO}_4)_3$ alluaudite phase: Synthesis, structure, and electrochemical properties as positive electrode in lithium and sodium batteries. *Chemistry of Materials*, 22(19), 5554–5562. <https://doi.org/10.1021/cm1015614>
- Uddin, M. J., Alaboina, P. K., & Cho, S. J. (2017). Nanostructured cathode materials synthesis for lithium-ion batteries. In *Materials Today Energy* (Vol. 5, pp. 138–157). Elsevier Ltd. <https://doi.org/10.1016/j.mtener.2017.06.008>
- Ul-Hamid, A. (2018). *A Beginners' Guide to Scanning Electron Microscopy*. Springer International Publishing. <https://books.google.co.in/books?id=Wyt1DwAAQBAJ>
- Vernickaitė, E., Lelis, M., Tsyntsaru, N., Pakštis, V., & Cesiulis, H. (n.d.). XPS studies on the Mo oxide-based coatings electrodeposited from highly saturated acetate bath. In *CHEMIJA. 2020* (Vol. 31, Issue 4).
- Vijayan, L., Cheruku, R., Govindaraj, G., & Rajagopan, S. (2011). Physical and electrical properties of combustion synthesized NASICON type $\text{Na}_3\text{Cr}_2(\text{PO}_4)_3$ crystallites: Effect of glycine molar ratios. *Materials Chemistry and Physics*, 130(3), 862–869. <https://doi.org/10.1016/j.matchemphys.2011.08.004>
- “Vision 2030” – *Natural Gas Infrastructure in India*. (2011).
- Wang, C., Li, W., Wang, X., Yu, N., Sun, H., & Geng, B. (2022). Open N-doped carbon coated porous molybdenum phosphide nanorods for synergistic catalytic hydrogen evolution reaction. *Nano Research*, 15(3), 1824–1830. <https://doi.org/10.1007/s12274-021-3759-3>
-

-
- Wang, G., Ciobotaru, M., & Agelidis, V. G. (n.d.). *MINIMISING OUTPUT POWER FLUCTUATION OF LARGE PHOTOVOLTAIC PLANT USING VANADIUM REDOX BATTERY STORAGE*.
- Wang, M., Dang, D., Meyer, A., Arsenault, R., & Cheng, Y.-T. (2020). Effects of the Mixing Sequence on Making Lithium Ion Battery Electrodes. *Journal of The Electrochemical Society*, 167(10), 100518. <https://doi.org/10.1149/1945-7111/ab95c6>
- Wang, M. Y., Zhao, X. X., Guo, J. Z., Nie, X. J., Gu, Z. Y., Yang, X., & Wu, X. L. (2022). Enhanced electrode kinetics and properties via anionic regulation in polyanionic $\text{Na}_{3+x}\text{V}_2(\text{PO}_4)_3-x(\text{P}_2\text{O}_7)_x$ cathode material. *Green Energy and Environment*, 7(4), 763–771. <https://doi.org/10.1016/j.gee.2020.11.026>
- Wang, P. F., You, Y., Yin, Y. X., & Guo, Y. G. (2018). Layered Oxide Cathodes for Sodium-Ion Batteries: Phase Transition, Air Stability, and Performance. In *Advanced Energy Materials* (Vol. 8, Issue 8). Wiley-VCH Verlag. <https://doi.org/10.1002/aenm.201701912>
- Wang, Y., Yu, X., Xu, S., Bai, J., Xiao, R., Hu, Y. S., Li, H., Yang, X. Q., Chen, L., & Huang, X. (2013). A zero-strain layered metal oxide as the negative electrode for long-life sodium-ion batteries. *Nature Communications*, 4. <https://doi.org/10.1038/ncomms3365>
- Wei, S., Mortemard de Boisse, B., Oyama, G., Nishimura, S., & Yamada, A. (2016). Synthesis and Electrochemistry of $\text{Na}_{2.5}(\text{Fe}_{1-y}\text{Mn}_y)\text{1.75}(\text{SO}_4)_3$ Solid Solutions for Na-Ion Batteries. *ChemElectroChem*, 3(2), 209–213. <https://doi.org/https://doi.org/10.1002/celec.201500455>
- Wen, B., Chernova, N. A., Zhang, R., Wang, Q., Omenya, F., Fang, J., & Whittingham, M. S. (2013a). Layered molybdenum (Oxy)pyrophosphate as cathode for lithium-ion batteries. *Chemistry of Materials*, 25(17), 3513–3521. <https://doi.org/10.1021/cm401946h>
- Wen, Y., He, K., Zhu, Y., Han, F., Xu, Y., Matsuda, I., Ishii, Y., Cumings, J., & Wang, C. (2014). Expanded graphite as superior anode for sodium-ion batteries. *Nature Communications*, 5. <https://doi.org/10.1038/ncomms5033>
- Weng, G. M., Simon Tam, L. Y., & Lu, Y. C. (2017). High-performance $\text{LiTi}_2(\text{PO}_4)_3$ anodes for high-areal-capacity flexible aqueous lithium-ion batteries. *Journal of Materials Chemistry A*, 5(23), 11764–11771. <https://doi.org/10.1039/c7ta00482f>
- Whittingham, M. S. (1976a). Electrical energy storage and intercalation chemistry. *Science*, 192(4244), 1126–1127. <https://doi.org/10.1126/science.192.4244.1126>
- Why did greenhouse gas emissions decrease in the EU between 1990 and 2012?* (2014).
-

-
- Wu, C., Kopold, P., Ding, Y. L., van Aken, P. A., Maier, J., & Yu, Y. (2015). Synthesizing Porous NaTi₂(PO₄)₃ Nanoparticles Embedded in 3D Graphene Networks for High-Rate and Long Cycle-Life Sodium Electrodes. *ACS Nano*, 9(6), 6610–6618. <https://doi.org/10.1021/acsnano.5b02787>
- Wu, M., Ni, W., Hu, J., & Ma, J. (2019). NASICON-Structured NaTi₂(PO₄)₃ for Sustainable Energy Storage. In *Nano-Micro Letters* (Vol. 11, Issue 1). Springer. <https://doi.org/10.1007/s40820-019-0273-1>
- Wu, Y., Liu, Z., Zhong, X., Cheng, X., Fan, Z., & Yu, Y. (2018). Amorphous Red Phosphorus Embedded in Sandwiched Porous Carbon Enabling Superior Sodium Storage Performances. *Small*, 14(12). <https://doi.org/10.1002/sml.201703472>
- Xiao, L., Lu, H., Fang, Y., Sushko, M. L., Cao, Y., Ai, X., Yang, H., & Liu, J. (2018). Low-Defect and Low-Porosity Hard Carbon with High Coulombic Efficiency and High Capacity for Practical Sodium Ion Battery Anode. *Advanced Energy Materials*, 8(20). <https://doi.org/10.1002/aenm.201703238>
- Yabuuchi, N., Kubota, K., Dahbi, M., & Komaba, S. (2014a). Research development on sodium-ion batteries. In *Chemical Reviews* (Vol. 114, Issue 23, pp. 11636–11682). American Chemical Society. <https://doi.org/10.1021/cr500192f>
- Yabuuchi, N., Matsuura, Y., Ishikawa, T., Kuze, S., Son, J.-Y., Cui, Y.-T., Oji, H., & Komaba, S. (2014). Phosphorus Electrodes in Sodium Cells: Small Volume Expansion by Sodiation and the Surface-Stabilization Mechanism in Aprotic Solvent. *ChemElectroChem*, 1(3), 580–589. <https://doi.org/https://doi.org/10.1002/celec.201300149>
- Yamamoto H, S. Muratsubaki, Kei Kubota, Mika Fukunishi, Hiromu Watanabe, Jungmin Kim,b and Shinichi Komaba. (2018). Synthesizing higher-capacity hard-carbons from cellulose for Na and K-ion batteries, *J. Mater. Chem. A*, 2018,6, 16844-16848. DOI <https://doi.org/10.1039/C8TA05203D>
- Yang, C., Xiang, Q., Li, X., Xu, Y., Wang, X., Xie, X., Li, C., Wang, H., & Wang, L. (2020). MoO₃ nanoplates: a high-capacity and long-life anode material for sodium-ion batteries. *Journal of Materials Science*, 55(26), 12053–12064. <https://doi.org/10.1007/s10853-020-04788-z>
- Yang, H., Xu, R., Yao, Y., Ye, S., Zhou, X., & Yu, Y. (2019). Multicore–Shell Bi@N-doped Carbon Nanospheres for High Power Density and Long Cycle Life Sodium- and Potassium-Ion Anodes. *Advanced Functional Materials*, 29(13). <https://doi.org/10.1002/adfm.201809195>
- Yang, L., Huang, Y., Li, X., Sheng, J., Li, F., Xie, Z., & Zhou, Z. (2018). Micro/Nanostructure-Dependent Electrochemical Performances of Sb₂O₃ Micro-Bundles as Anode Materials for Sodium-Ion Batteries. *ChemElectroChem*, 5(18), 2522–2527. <https://doi.org/10.1002/celec.201800618>
-

-
- Yang, L., Zhang, Z., Xia, L., Zhao, Y., Li, F., Zhang, X., Wei, J., & Zhou, Z. (2019). Integrated insights into Na⁺ storage mechanism and electrochemical kinetics of ultrafine V₂O₃/S and N co-doped rGO composites as anodes for sodium ion batteries. *Journal of Materials Chemistry A*, 7(39), 22429–22435. <https://doi.org/10.1039/c9ta08025b>
- Yang, M., Luo, J., Guo, X., Chen, J., Cao, Y., & Chen, W. (2022). Aqueous Rechargeable Sodium-Ion Batteries: From Liquid to Hydrogel. In *Batteries* (Vol. 8, Issue 10). MDPI. <https://doi.org/10.3390/batteries8100180>
- Yang, Z., Zhang, J., Kintner-Meyer, M. C. W., Lu, X., Choi, D., Lemmon, J. P., & Liu, J. (2011). Electrochemical energy storage for green grid. In *Chemical Reviews* (Vol. 111, Issue 5, pp. 3577–3613). <https://doi.org/10.1021/cr100290v>
- Yasushi Uebou, Shigeto okada, *Electrochemical alkali metal intercalation into 3D framework of MoP₂O₇*, *Electrochemistry*, 5, 2003, 308-312
- Yu, C. Y., Park, J. S., Jung, H. G., Chung, K. Y., Aurbach, D., Sun, Y. K., & Myung, S. T. (2015). NaCrO₂ cathode for high-rate sodium-ion batteries. *Energy and Environmental Science*, 8(7), 2019–2026. <https://doi.org/10.1039/c5ee00695c>
- Yu, H., Guo, S., Zhu, Y., Ishida, M., & Zhou, H. (2014). Novel titanium-based O₃-type NaTi_{0.5}Ni_{0.5}O₂ as a cathode material for sodium ion batteries. *Chemical Communications*, 50(4), 457–459. <https://doi.org/10.1039/c3cc47351a>
- Zebra battery technologies for all electric smart car SPEEDAM 2006, International Symposium on power electronics.* (n.d.).
- Zhang, K., Hu, Z., Liu, X., Tao, Z., & Chen, J. (2015). FeSe₂ microspheres as a high-performance anode material for Na-ion batteries. *Advanced Materials*, 27(21), 3305–3309. <https://doi.org/10.1002/adma.201500196>
- Zhang, X., Li, Y. L., Lin, Y., Yang, T., Shi, M., & Xu, W. (2020). A flexible LiFePO₄/carbon nanotube/reduced graphene oxide film as self-supporting cathode electrode for lithium-ion battery. *Ionics*, 26(3), 1537–1546. <https://doi.org/10.1007/s11581-019-03328-3>
- Zhao, W., Choi, W., & Yoon, W. S. (2020). Nanostructured electrode materials for rechargeable lithium-ion batteries. In *Journal of Electrochemical Science and Technology* (Vol. 11, Issue 3, pp. 195–219). Korean Electrochemical Society. <https://doi.org/10.33961/jecst.2020.00745>
- Zhao, X., Gu, Z., Li, W., Yang, X., Guo, J., & Wu, X. (2020). Cover Feature: Temperature-Dependent Electrochemical Properties and Electrode Kinetics of Na₃V₂(PO₄)₂O₂F Cathode for Sodium-Ion Batteries with High Energy Density (Chem. Eur. J. 35/2020). *Chemistry – A European Journal*, 26(35), 7734–7734. <https://doi.org/10.1002/chem.202001817>
-

-
- Zhao, X. X., Gu, Z. Y., Li, W. H., Yang, X., Guo, J. Z., & Wu, X. L. (2020). Temperature-Dependent Electrochemical Properties and Electrode Kinetics of Na₃V₂(PO₄)₂O₂F Cathode for Sodium-Ion Batteries with High Energy Density. *Chemistry - A European Journal*, 26(35), 7823–7830. <https://doi.org/10.1002/chem.202000943>
- Zhao, Y., Wang, F., Wang, C., Wang, S., Wang, C., Zhao, Z., Duan, L., Liu, Y., Wu, Y., Li, W., & Zhao, D. (2019). Encapsulating highly crystallized mesoporous Fe₃O₄ in hollow N-doped carbon nanospheres for high-capacity long-life sodium-ion batteries. *Nano Energy*, 56, 426–433. <https://doi.org/10.1016/j.nanoen.2018.11.040>
- Zhu, J., He, Q., Liu, Y., Key, J., Nie, S., Wu, M., & Shen, P. K. (2019). Three-dimensional, hetero-structured, Cu₃P@C nanosheets with excellent cycling stability as Na-ion battery anode material. *Journal of Materials Chemistry A*, 7(28), 16999–17007. <https://doi.org/10.1039/c9ta04035h>
- Zhu, X., Mochiku, T., Fujii, H., Tang, K., Hu, Y., Huang, Z., Luo, B., Ozawa, K., & Wang, L. (2018). A new sodium iron phosphate as a stable high-rate cathode material for sodium ion batteries. *Nano Research*, 11(12), 6197–6205. <https://doi.org/10.1007/s12274-018-2139-0>
- Zhu, Y., Wen, Y., Fan, X., Gao, T., Han, F., Luo, C., Liou, S. C., & Wang, C. (2015). Red phosphorus-single-walled carbon nanotube composite as a superior anode for sodium ion batteries. *ACS Nano*, 9(3), 3254–3264. <https://doi.org/10.1021/acsnano.5b00376>

List of Publications

- NASICON-structured $\text{Na}_3\text{Fe}_2\text{PO}_4(\text{SO}_4)_2$: A potential cathode material for rechargeable sodium-ion batteries. **Saurabh Kumar**, R. Ranjeeth, Rajiv Prakash, Preetam Singh. *Dalton Trans.*, 2022,**51**, 5834. <https://doi.org/10.1039/d2dt00780k>.
- Eldfellite structured $\text{NaCr}(\text{SO}_4)_2$: A potential anode for rechargeable Na-ion and Li-ion batteries. **Saurabh Kumar**, Rakesh Mondal, Rajiv Prakash, Preetam Singh. *Dalton Trans.*, 2022,**51**, 11823-11833, <https://doi.org/10.1039/D2DT00573E>
- $\text{Mo}_2\text{P}_2\text{O}_{11}$: A Potential cathode material for rechargeable sodium-ion batteries. **Saurabh Kumar**, Mahatim Singh, Rakesh Mondal, Mridul Kumar, Preetam Singh, Rajiv Prakash, *Energy and Fuels*, 2022, <https://doi.org/10.1021/acs.energyfuels.2c03158>
- Facile Polypyrrole NASICON($\text{PPy}/\text{Na}_3\text{Fe}_2(\text{SO}_4)_2\text{PO}_4$) electrode material for Hydrogen evolution reaction. Ajay Kumar, **Saurabh Kumar**, Subhajit Jana, Rajpal, and Rajiv Prakash, *Energy and Fuels*, 2022, 36, 18, 11142-11153 <https://doi.org/10.1021/acs.energyfuels.2c01893>
- Combustion-Synthesized KNiPO_4 : A Non-toxic, Robust, Intercalating Battery-Type Pseudocapacitive Electrode for Hybrid Supercapacitors as a Large-Scale Energy Storage Solution. Mahatim Singh, **Saurabh Kumar**, Rakesh Mondal, Preetam Singh, Rajiv Prakash, Neeraj Sharma, *Energy and Fuels*, 2023, 37, 5, 4094–4105 <https://doi.org/10.1021/acs.energyfuels.2c04092>
- Investigation of synergistic effect in Polypyrrole/Ni-doped NASICON composite for and enhanced hydrogen evolution reaction. Ajay Kumar, **Saurabh Kumar**, Subhajit Jana, Rajiv Prakash, *Energy and Fuels*, 2023, <https://doi.org/10.1021/acs.energyfuels.2c04178>

List of Conferences / Workshop Attended

Conferences

1. Poster Presentation at “The International Conference on Beyond Fossil Fuels: The Future of Alternative Energy Technology” organized by IIT BHU Varanasi 23-25 July 2022.
2. Oral Presentation at “2nd International Conference on Sustainable Materials and Technologies for Bio and Energy Applications (SMTBEA-2022)” organized by SSN College of Engineering 13-14 July 2022.
3. Attended 8th International Conference on Advances in Energy Research (ICAER) organized by IIT Bombay 7th-9th July 2022.
4. Poster presentation at “International Conference on Supercapacitor and Batteries-India 2022,” organized by IIT Kharagpur March 28-30, 2022.

Workshops

1. Attended Indo-Japan Workshop on “Silicon Crystal Growth for Photovoltaic Applications” organized by SSN Research Centre Chennai and Nagoya University Japan on 7th January 2022.
2. Attended a six-day international workshop on “Smart Materials Sensors and Energy Devices (SMSSED 2020)” organized by SSN College of Engineering on 25th – 30th May 2020.
3. Attended International Virtual Workshop on “Bioelectronic Medicine” jointly organized by IIT(BHU) and IISc Bangalore on 16th December 2021.