

Sathiya Mariyappan

Scientist
Centre for Automotive Energy Materials (CAEM)
ARCI Chennai
IITM Research Park, Phase 1
6 Kanagam Road, Taramani
Chennai 600113
Phone: 044- 66632809 (India)
Email: sathiya@arci.res.in



Research area of Interest:

Electrochemical energy storage devices with particular emphasis on alkali metal ion batteries (Li and Na)

Academic Qualifications:

- 2013 **Ph. D** in Chemistry (*highly commended*), Thesis title: “Synthetic routes for the preparation of rechargeable Li-ion battery electrode materials”, CSIR-CECRI, Karaikudi, India
- 2005 **M. Sc Chemistry** (91 %, *University Gold Medalist*; cleared GATE 2005 and 2006) SR College, Bharathidasan University, Trichy, India
- 2003 **B. Sc Chemistry** (92%) SR College, Bharathidasan University, Trichy, India

Professional Profile and Research Activities

- 2014 Feb- present **Scientist** – Centre for Automotive Energy Materials, ARCI, Chennai
Electrochemical energy storage devices towards stationary applications: Walking beyond the horizon of Li-ion batteries.
- 2012 Apr –2014 Aug **Postdoctoral Fellow** – College De France, 11 Place Marcellin Berthelot, 75005, Paris and Laboratoire de Réactivité et de Chimie Des Solides, CNRS, Université de Picardie, Jules Verne, Amiens, France
Synthesis, structure, characterization and electrochemical reactivity of Li_2MO_3 based oxides. Their reactivity, understanding through in-situ electrochemical studies.

2011 Apr- 2012 Apr **CSIR-Senior Research Fellow (SRF)** – Central Electrochemical Research Institute, Chennai, India.

Synthetic routes for the preparation of rechargeable Li-ion battery electrode materials.

2007 Aug-2010 Aug **CSIR- Fellow under Quick Hire Scheme (QHS)** - Central Electrochemical Research Institute, Karaikudi, India.

Synthetic routes for the preparation of rechargeable Li-ion battery electrode materials.

2006 Sep-2007 July **Project JRF** – Solid State and Structural Chemistry Unit (SSCU), Indian Institute of Science, Bangalore, India.

Synthesis of new inorganic host materials for the selective removal of nuclear waste.

Skills & Techniques

- **Material synthesis**: Ability to prepare inorganic materials using various synthetic methods- ceramic synthesis, solution synthesis such as sol-gel, combustion, hydrothermal, solvothermal, ion exchange reactions etc and synthesis by special techniques like Spark Plasma Sintering, etc.
- **Structural characterisations**: Hands on experience with X-ray Diffraction, Rietveld refinement, synchrotron measurements.
- Experienced in SEM, XPS, TEM, UV, IR, Thermal analysis and photocatalysis.
- **Electrochemical characterizations**: Hands on experience in alkali metal ion batteries (Li, Na and K): Cell assembly and characterisations involving GCPL, four probe conductivity, impedance, constant power experiments and voltammetric measurements
- Hands on experience in *in-situ* cell assembly and analysis (*in-situ* XRD, *in-situ* synchrotron, *in-situ* NMR and *in-situ* EPR etc).

Research Publications:

1. **M. Sathiya**, J. B. Leriche, E. Salager, D. Gourier, J.-M. Tarascon, H. Vezin, “Electron Paramagnetic resonance Imaging for live monitoring of Li-ion batteries”, **Nature Communications**, 6: 6276 (2015).
2. **M. Sathiya**, A. M. Abakumov, K. Ramesha, D. Foix, G. Rousse, C. P. Laisa, D. Gonbeau, M-L. Doublet, A. S. Prakash, G. Van Tendeloo, J.-M. Tarascon, “Origin of voltage decay in high capacity layered oxide electrodes,” **Nature Materials** 14 p. 230-238 (2014).

3. **M. Sathiya**, G. Rouse, K. Ramesha, C. P. Laisa, H. Vezin, M. T. Sougrati, M-L. Doublet, D. Foix, D. Gonbeau, W. Walker, A. S. Prakash, M. Ben Hassine, L. Dupont, J.-M. Tarascon, "Reversible anionic redox chemistry in high capacity layered oxide electrodes," **Nature Materials** 12 p. 827-835 (2013)
4. **M. Sathiya**, K. Ramesha, G. Rouse, D. Foix, D. Gonbeau, K. Guruprakash, A. S. Prakash, M. L. Doublet, J.-M. Tarascon, "Li₄NiTeO₆ as a positive electrode for Li-ion batteries", **Chemical Communications** 49 p. 11376-11378 (2013).
5. **M. Sathiya**, K. Ramesha, G. Rouse, D. Gonbeau, A. S. Prakash, J.-M. Tarascon, "High performance Li₂Mn_yRu_{1-y}O₃ cathode materials for rechargeable Li-ion batteries: Their understanding", **Chemistry of Materials**, 25 p. 1121-1131 (2013)
6. M. Ati, **M. Sathiya**, S. Boulineau, M. Reynaud, A. Abakumov, G. Rouse, B. C. Melot, G. Van Tendeloo, J.-M. Tarascon, "Understanding and promoting the rapid preparation of the triplite phase of LiFeSO₄F for use as a large-potential Fe cathode", **Journal of American Chemical Society**, 134 (44) p. 18380-18387 (2012).
7. N. Recham, G. Rouse, M. T. Sougrati, J.-N. Chotard, C. Frayre, **M. Sathiya**, B. C. Melot, J.-C. Jumas, J.-M. Tarascon, "Preparation and characterisation of a robust FeSO₄F-based framework for alkali ion insertion electrodes," In press, **Chemistry of Materials**; 24 (22) p. 4363-4370 (2012).
8. **M. Sathiya**, K. Hemalatha, K. Ramesha, J. M- Tarascon, A. S. Prakash, "Synthesis, structure and electrochemical properties of the layered sodium insertion cathode material NaNi_{1/3}Mn_{1/3}Co_{1/3}O₂", **Chemistry of Materials**, 24 (10) p. 1846- 1853 (2012)
9. **M. Sathiya**, A.S. Prakash, K. Ramesha, J-M. Tarascon and A.K. Shukla, "V₂O₅-anchored Carbon Nanotubes for enhanced electrochemical energy storage" **Journal of American Chemical Society**., 133(40) p. 16291(2011).
10. A. S. Prakash, P. Manikandan, K. Ramesha, **M. Sathiya**, J-M. Tarascon, and A. K. Shukla, "Solution-Combustion Synthesized Nanocrystalline Li₄Ti₅O₁₂ As High-Rate Performance Li-ion Battery Anode" **Chemistry of Materials**, 22, p2857-2863 (2010).
11. **M. Sathiya**, A.S. Prakash, K. Ramesha and A.K. Shukla, "Rapid synthetic routes to prepare LiNi_{1/3}Mn_{1/3}Co_{1/3}O₂ as a high voltage, high-capacity Li-ion battery cathode". **Mater. Res. Bull.** 44 (10), p.1990-1994 (2009).
12. **M. Sathiya**, A.S. Prakash, K. Ramesha and A.K. Shukla, "Nitrate-melt synthesised HT-LiCoO₂ as a superior cathode material for Lithium-ion batteries" **Materials**, 2, p. 857-868 (2009).

13. **M. Sathiya**, A. S. Prakash, K. Ramesha and A. K. Shukla “Nitrates-melt synthesized $\text{LiNi}_{0.8}\text{Co}_{0.2}\text{O}_2$ and its performance as cathode in Li-ion cells”, *Bulletin Of Material Science*, 34, p. 7 (2011).
14. Ramdas B. Khomane, A. S. Prakash, K. Ramesha, **M. Sathiya**, “ CTAB-assisted sol-gel synthesis of $\text{Li}_4\text{Ti}_5\text{O}_{12}$ and its performance as anode material for Li-ion batteries”, *Material Research Bulletin*, 46(7) p. 1139 (2011).
15. K. Ramesha, A. S. Prakash, **M. Sathiya**, Grithar Madras, A. K. Shukla “Synthesis and photocatalytic properties of $\text{Ag}[\text{Li}_{1/3}\text{Ru}_{2/3}]\text{O}_2$: A new delafossite oxide” *Material Science and Engineering B*, 176, 141-146 (2011).
16. K. Ramesha, A. S. Prakash, **M. Sathiya**, Grithar Madras, A. K. Shukla “Synthesis of new $(\text{Bi},\text{La})_3\text{MSb}_2\text{O}_{11}$ phases (M = Cr, Mn, Fe) with KSbO_3 -type structure and their magnetic and photocatalytic properties” *Bulletin Of Material Science*, 34, p. 271-277 (2011).
17. R. Ramachandran, **M. Sathiya**, K. Ramesha, A. S Prakash, Giridhar Madras, A. K. Shukla, “Photocatalytic properties of KBiO_3 and LiBiO_3 with tunnel structures” *Journal of Chemical Sciences*, 123 (4), p.517-524 (2011).
18. E. Salager, V. Sarou-Kanian, **M. Sathiya**, M. Tang, J-B. Leriche, P. Melin, Z. Wang, C. Bessada, M. Deschamps and J-M. Tarascon, “Solid state NMR spectroscopy of the family of positive electrode materials $\text{Li}_2\text{Ru}_{(1-y)}\text{Sn}_y\text{O}_3$ for Li-ion batteries”, *Chemistry of Materials* 26(24) p7009-7019 (2014).
19. P. Rozier, **M. Sathiya**, Alagar Raj Paulraj, D.e Foix, T. Desaunay, P. L. Taberna, P. Simon, J-M. Tarascon “Anionic redox chemistry in Na-rich $\text{Na}_2\text{Ru}_{1-y}\text{Sn}_y\text{O}_3$ positive electrode material”, *Electrochemical Communications* 53 p 29-32 (2015).
20. E. McCalla, M. T. Sougrati, G. Rousse, E. J. Berg, A. Abakumov, N. Recham, K. Ramesha, **M. Sathiya**, R. Dominko, G. Van Tendeloo, P. Novák, and J-M Tarascon “Understanding the roles of anionic redox and oxygen release during electrochemical cycling of lithium rich layered $\text{Li}_4\text{FeSbO}_6$ ”, *Journal of American chemical Society* 137 p 4804- 4814 (2015).
21. J-M. Tarascon, E. McCalla, A. S. Prakash, E. Berg, M. Saubanère, A. Abakumov, D. Foix, M. T. Sougrati, G. Rousse, F. Lepoivre, **Sathiya Mariyappan**, M-L Doublet, D. Gonbeau, P. Novák, B. Klobes, R. Hermann, and G. Van Tendeloo, “Reversible Li-intercalation Through Oxygen Reactivity in Li-rich Li-Fe-Te Oxide Materials” *Journal of Electrochemical Society* 162 (7) p A1341- A1351 (2015).

Patents

1. **M. Sathiya**, K. Ramesha, A. S. Prakash, J.-M. Tarascon, Complex oxides of alkali metal and tetravalent metals, application number: 12197509.8-1359, Europe.

Papers presented/accepted in international conferences/seminars

1. **M. Sathiya**, “Sodium ion batteries as alternate energy storage devices: Status, challenges and perspectives”, April 28, 2015, **PSSL-DSST, RCI**, Hyderabad (**Invited**).
2. **M. Sathiya**, “Fundamental advancements boosting the development of high capacity Li-rich lamellar oxides”, October 15, 2014, **ARCI, Chennai** (Invited).
3. **M. Sathiya**, “Fundamental advances boosting the development of high capacity Li-rich lamellar compounds”, March 11, 2014, **Robert Bosch GMBH, Stuttgart**, Germany (**Invited**).
4. J. M. Tarascon, **M. Sathiya**, K. Ramesha, A. M. Abakumov, G. Rouse, D. Gonbeau, M. L. Doublet, A. S. Prakash and G. Van Tendeloo,” Present understanding of the high capacity layered oxide electrodes”, **IMLB- 2014, Como**, Italy.
5. **M. Sathiya**, K. Ramesha, G. Rouse, A. Abakumov, G. Van Tendeloo, A. S. Prakash, H. Vezin, M. T. Sougrati, M. L. Doublet, D. Foix, D. Gonbeau and J.-M. Tarascon, “Understanding the origin of high capacity and voltage decay associated with Li_2MO_3 based Li-ion battery electrodes”, (accepted for oral presentation) **MRS-Spring meeting**, April 2014.
6. **M. Sathiya**, K. Ramesha, G. Rouse, A. S. Prakash, M. L. Doublet, D. Foix, D. Gonbeau and J.-M. Tarascon, “Synthesis, structure and Li-electrochemical reactivity of $\text{Li}_4\text{NiTeO}_6$ ”, (accepted for oral presentation) **MRS-Spring meeting**, April 2014.
7. **M. Sathiya**, G. Rouse, K. Ramesha, A. S. Prakash, C.P. Laisa, H. Vezin, M. T. Sougrati¹, M. L. Doublet, D. Foix, D. Gonbeau, W. Walker, M. Ben Hassine, L. Dupont and J.-M. Tarascon, “ Anion-cation redox chemistry in high capacity Li_2MO_3 based cathodes”, Lithium Ion Battery Discussion (**LIBD**), June 2013, Arcachon, France.
8. **M. Sathiya**, K. Hemalatha, C. Senthil, K. Ramesha and A. S. Prakash, “ V_2O_5 anchored carbon nano tubes as a host for sodium ion intercalation”, paper presented in Asian Conference on Electrochemical Power Systems (**ACEPS**) January 2012, Chennai, India.