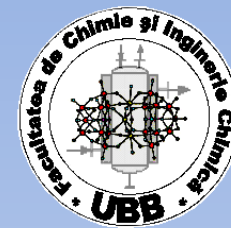




**UNIVERSITATEA „BABEȘ-BOLYAI”, CLUJ-NAPOCA
FACULTATEA DE CHIMIE ȘI INGINERIE CHIMICĂ
ȘCOALA DOCTORALA DE INGINERIE CHIMICĂ**



Electrochemical power sources with manganese based cathodes

Scientific Advisor

Prof. dr. eng. Petru ILEA

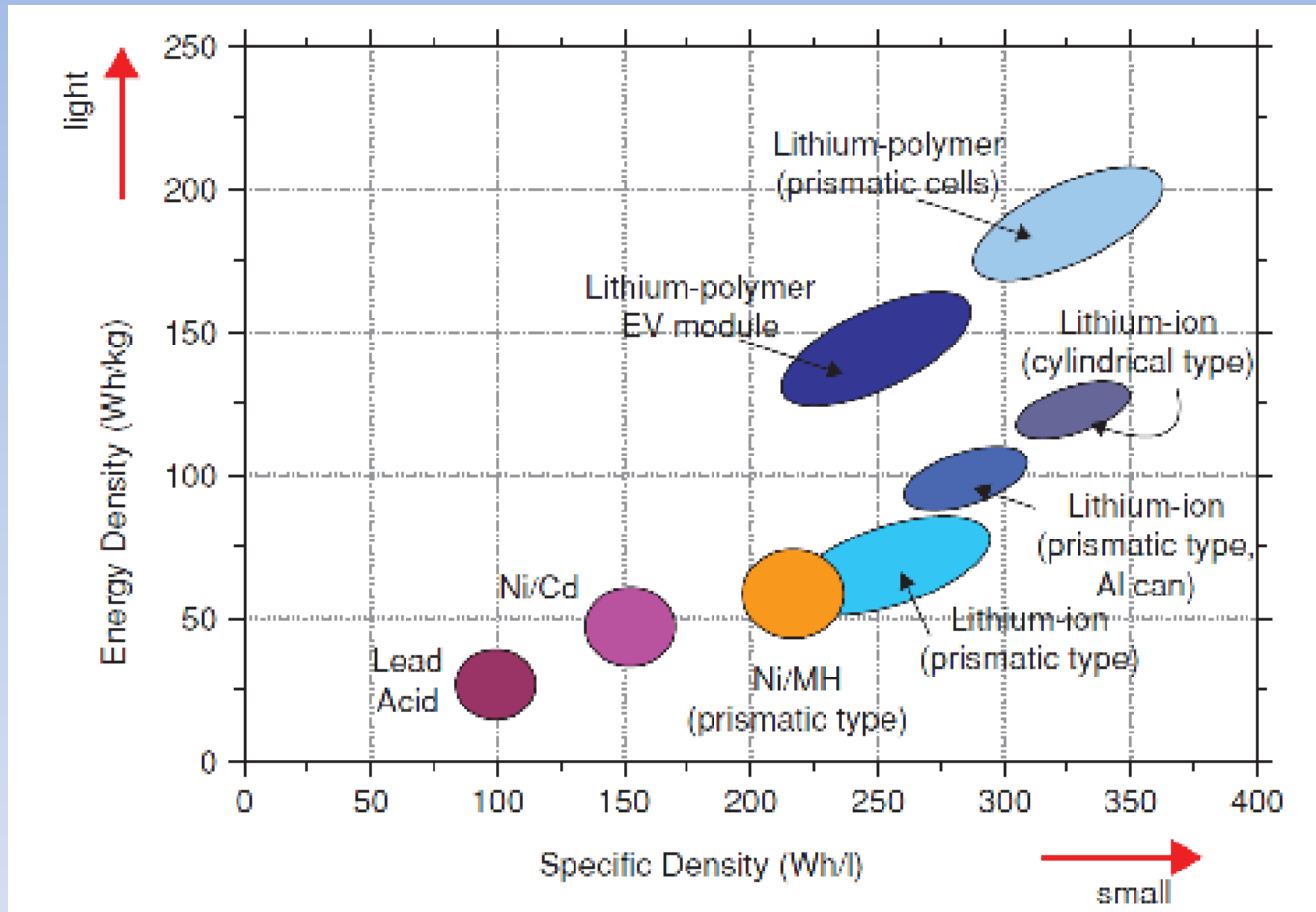
PhD Student

Eng. Alexandru-Horațiu MARINCAȘ

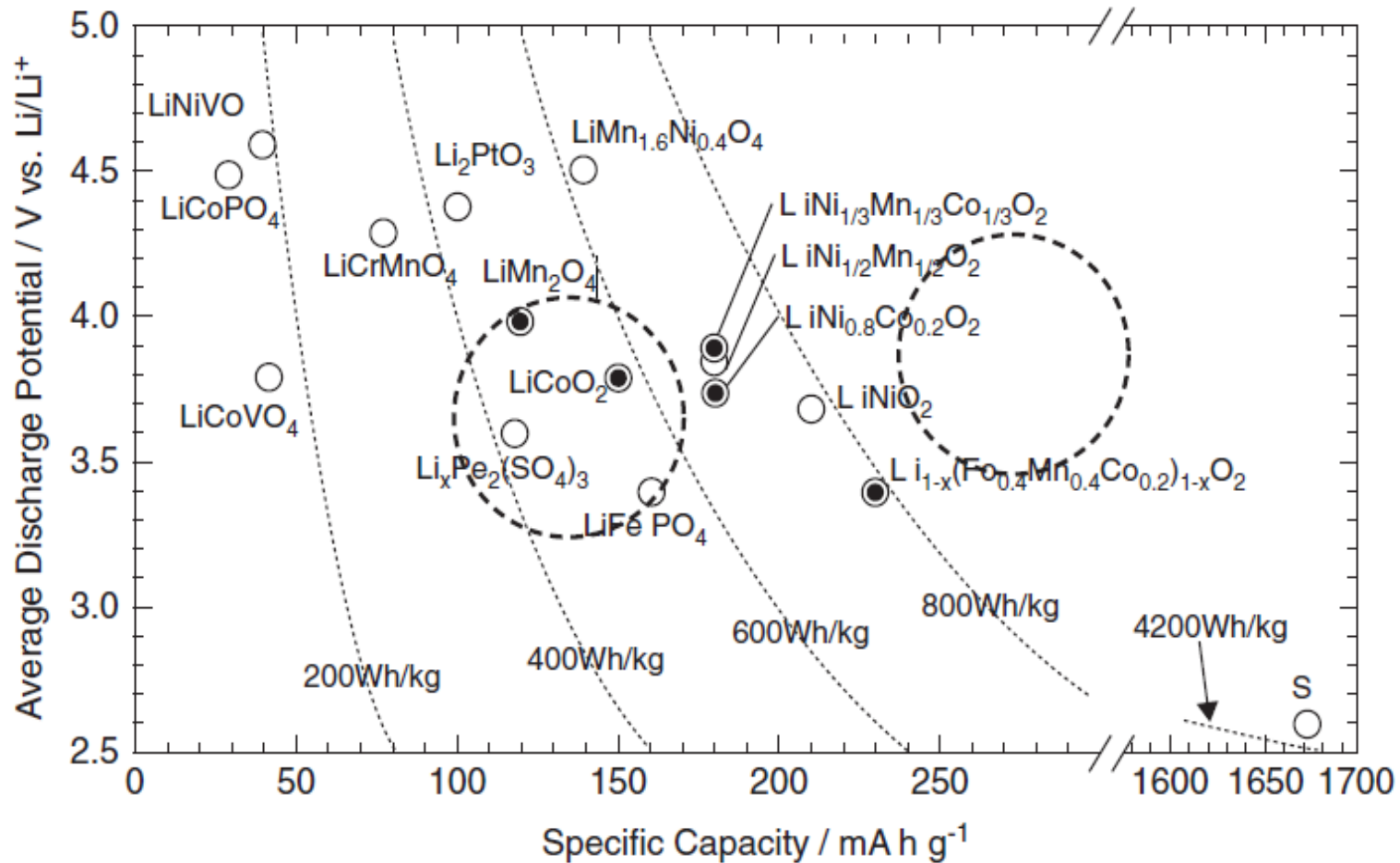
Specific objectives

1. Synthesis of $\text{LiM}_y\text{Mn}_{2-y}\text{O}_4$ (M=Ti, Ni, Ge, Fe, Zn), for lithium-ion batteries cathode.
2. Physical and electrochemical characterization of synthesized oxides
3. Correlation between synthesis method, structure and electrochemical properties synthesized oxides
4. Develop of novel aqueous electrolytes for Aqueous Rechargeable Li-ion batteries (ARLB)
5. Synthesis and electrochemical characterization of electrocatalysts used in oxygen reduction reaction (ORR)

1.Introduction



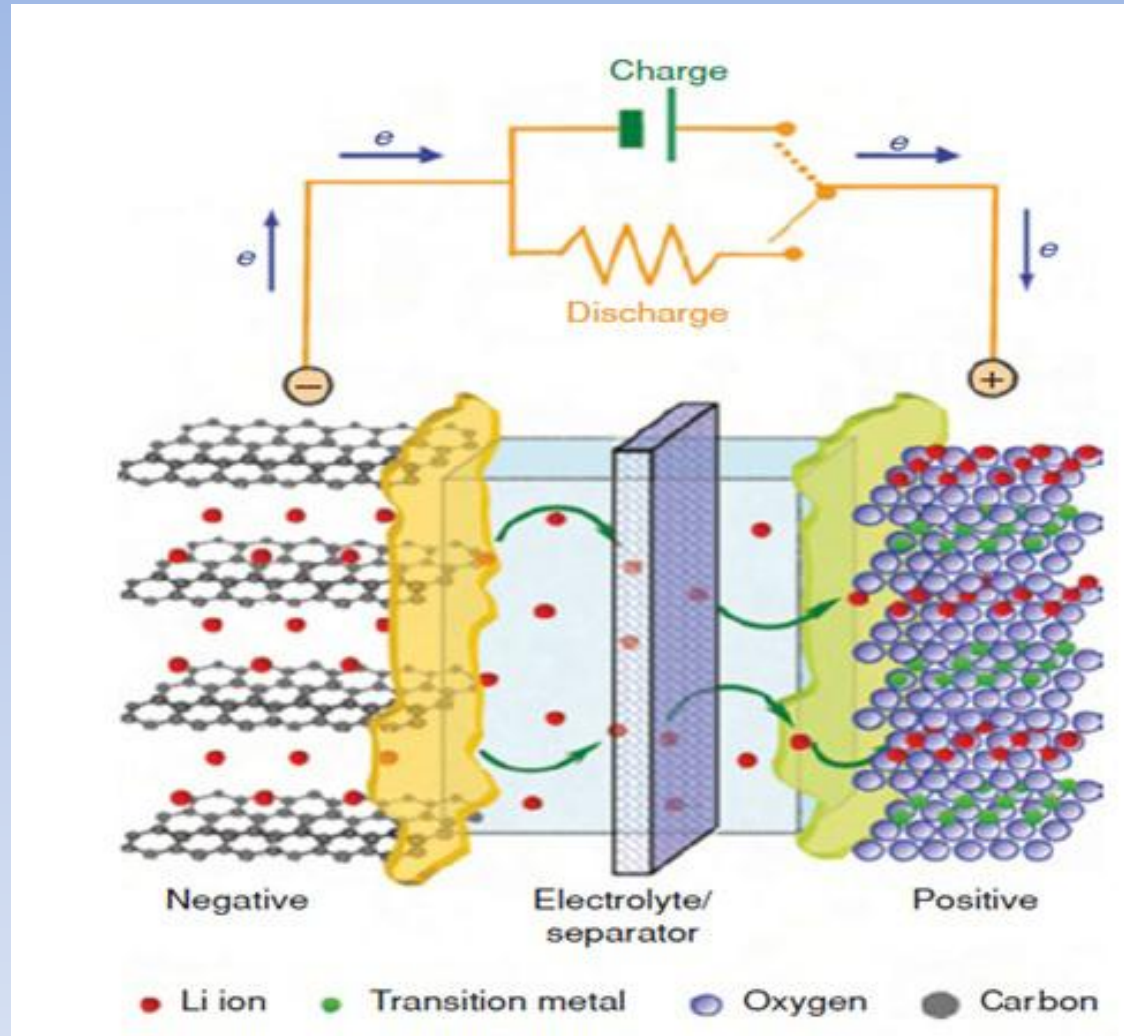
Energy density(Wh/kg) vs specific density (Wh/l) for some batteries



Energy density, voltage, specific capacity for active cathode materials

B. Scrosati, K.M. Abraham, Walter van Schalkwijk, J. Hassoun, *Lithium Batteries, Advanced Technologies and Applications*, Wiley, 2013

Lithium-ion battery

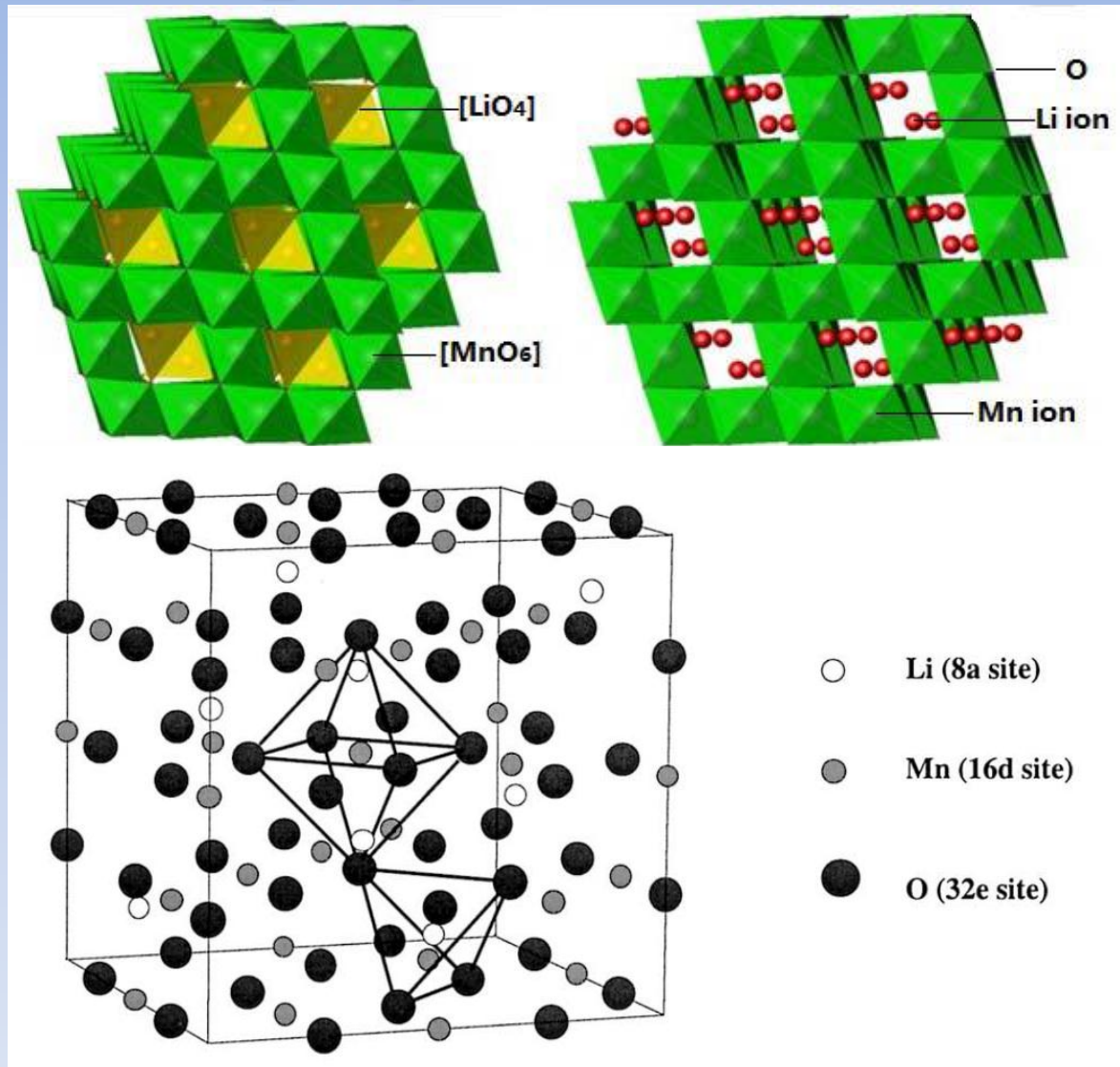


B. Scrosati, K.M. Abraham, Walter van Schalkwijk, J. Hassoun, *Lithium Batteries, Advanced Technologies and Applications*, Wiley, 2013

Materials used in lithium-ion batteries

Material	Abbreviation	Uses
LiCoO_2 (60% Co)	LCO	-cellphone -laptops -digital camera
LiMn_2O_4	LMO	-power tools
LiFePO_4	LFP	-medical devices
LiNiMnCoO_2 (10-20% Co)	NMC	
LiNiCoAlO_2 (9% Co)	NCA	-electric propulsion systems
$\text{Li}_4\text{Ti}_5\text{O}_{12}$	LTO	

LiMn₂O₄ spinel structure



2.Synthesis methods

- Pechini process;
- chemical coprecipitation;
- sol-gel method;
- solid state reactions;
- hydrothermal reactions;
- inverse microemulsions method.

LiMn₂O₄ :

Advantages	Disadvantages
-low fabrication cost	-oxygen vacancies formation during slow dissolution of manganese in electrolyte
-enough manganese sources	-Jahn-Teller structural distortion
-easy fabrication process	
-environmental friendly	

LiMn₂O₄ vs LiCoO₂

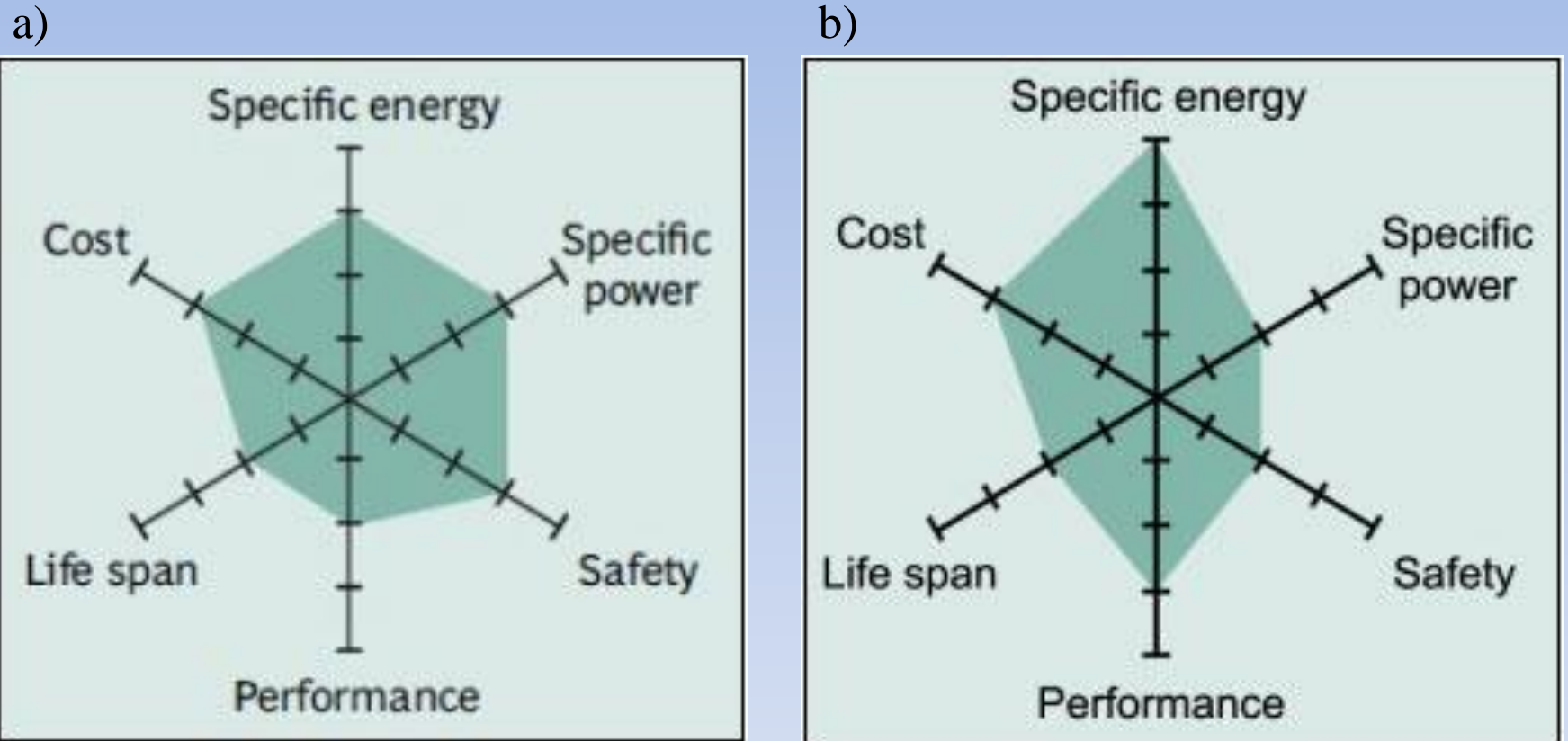


Figura 4 - *LiMn₂O₄ (a) , respectively aLiCoO₂ (b) performance*

http://batteryuniversity.com/learn/article/explaining_lithium_ion_chemistries

3. Articles

Alexandru-Horațiu Marincaș, Firuța Goga, Sorin-Aurel Dorneanu, Petru Ilea, *Sol-gel synthesis of nanosized LiMn_2O_4 particles and their electrochemical characterization in aqueous electrolyte*, **Romanian Chemical Engineering Society Bulletin**, under review

Thank you for your attention!