



UNIVERSITÄT LEIPZIG

ISOLE

CERN

β -NMR analysis of Ionic Liquids

Katarzyna Dziubińska-Kühn

betaDropNMR collaboration



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ADAM MICKIEWICZ
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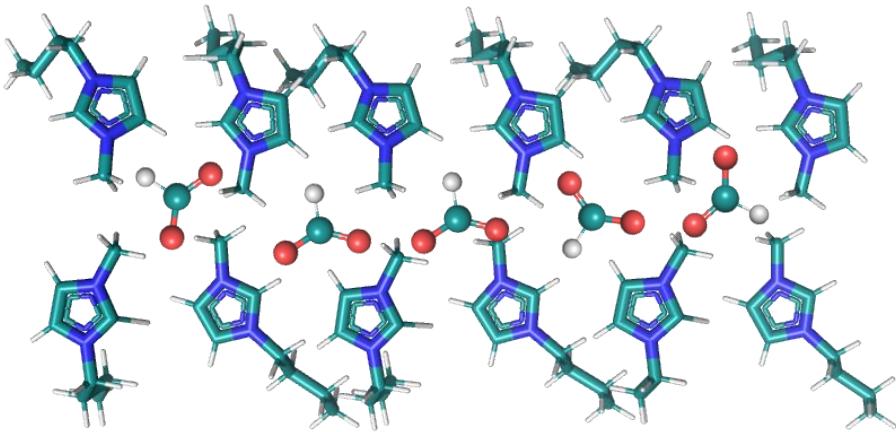
THE UNIVERSITY OF
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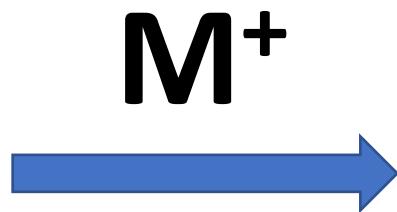
Czech Academy
of Sciences

B. Karg, A. Antusek, N. Azaryan, M. Baranowski, M. Bissell, L. Cerato, J. Croese, R. Harding, R. Jolivet, T. Kanellakopoulos, M. Kozak, K. Kulesz, M. Madurga Flores, J. Matysik, S. Mohr, G. Neyens, S. Pallada, M. Pupier, A. Skrzypczak, J. Viger-Gravel, S. Warren, J. Wolak, D. Zakoucky, **M.Kowalska**

Limitations of alkali metal chemistry

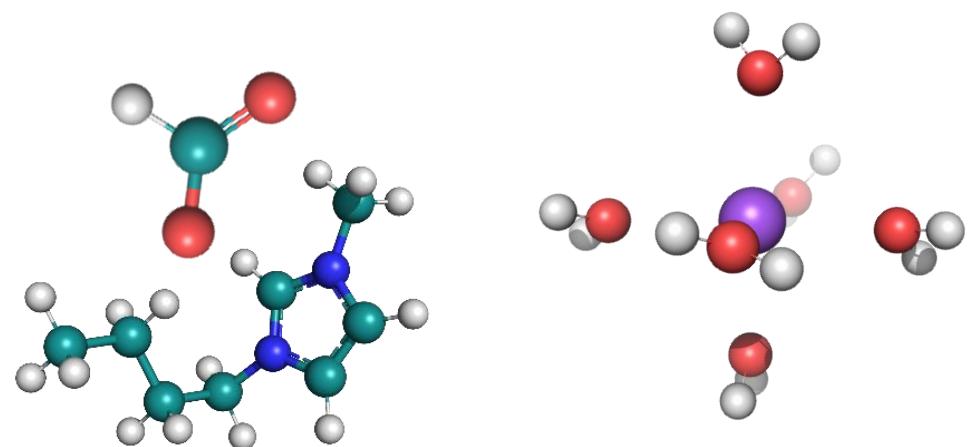
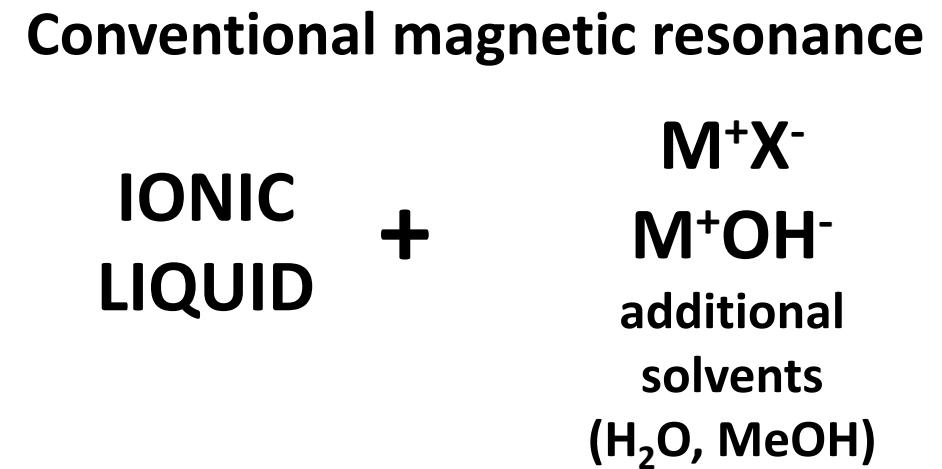
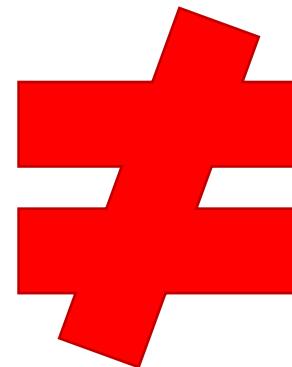
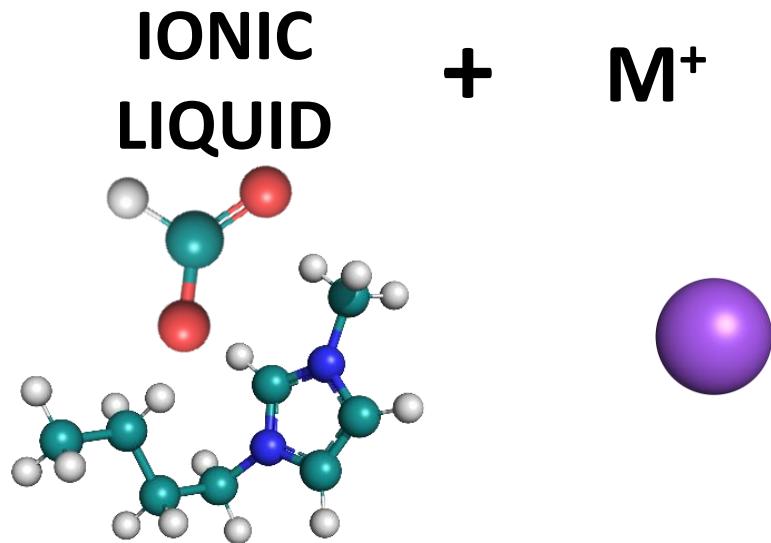


highly ordered ionic liquid network



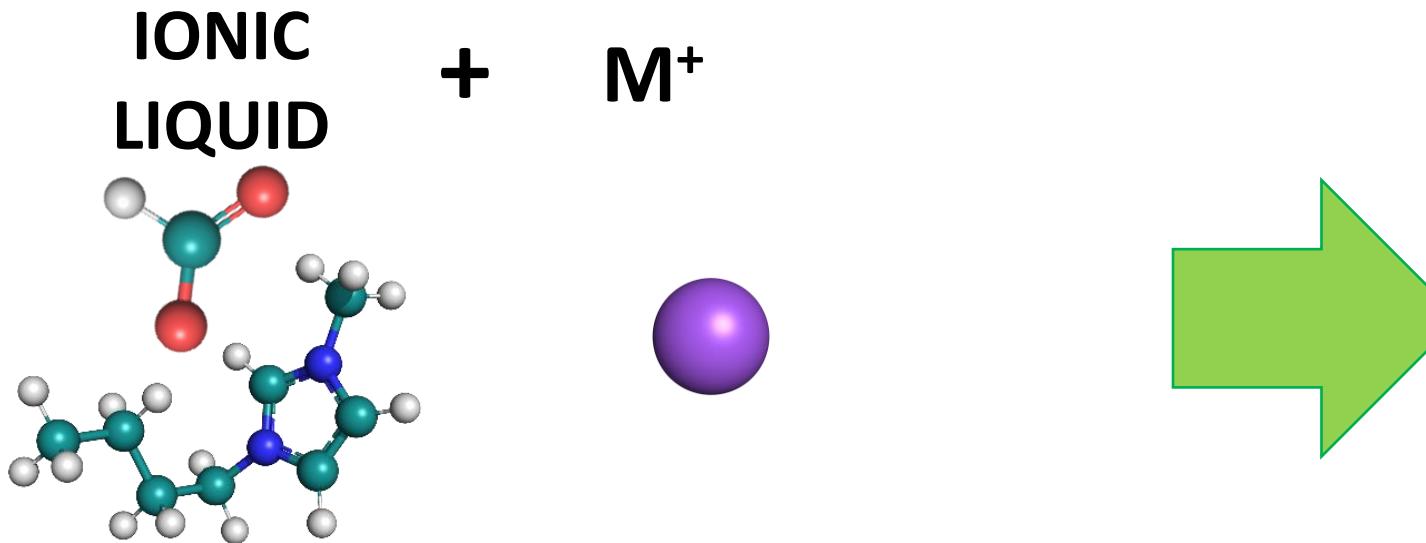
- Batteries
 - Lubricants
 - Energy storage
-
- Conductivity
 - Viscosity
 - Thermal property
 - Diffusivity

Structural analysis of Ionic Liquid – metal network



Structural analysis of Ionic Liquid – metal network

β -detected magnetic resonance



CHEMICAL INFORMATION
IMPOSSIBLE TO GAIN WITH
CONVENTIONAL CHEMISTRY

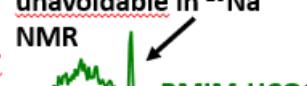
- direct implantation of ^{26}Na atoms into Ionic Liquid
- absolute shielding of metal cation with ppm resolution
- ab initio calculated ^{26}Na resonance reference

amorphatic side chain
 possible space for water aggregation
 • β -particles will be emitted in the spin direction
 • Resonance phenomenon comes from NMR

solvents
 → ionic liquid

 ...ed in IL cavities


IL needed to form the aggregation
 1.5 2
 concentration [1/mM]

um NMR results
 liquid – Na^+ solution without water
 water clusters are unavoidable in ^{23}Na NMR


Shielding and chemical shift reference:


Ab
 $\sigma_{26\text{Na}} = 1$
 Required:
 • accurate (ppm level)
 • in-situ ^1H NMR reference
 • magnetic susceptibility

Isotope	I	$t_{1/2}/(r)$
^{23}Na	3/2	stable
^{26}Na	3	1.2 years
^{27}Na	5/2	
^{28}Na	1	
^{29}Na	3/2	
^{30}Na	2	
^{31}Na	3/2	

Ref. R. D. Hardin