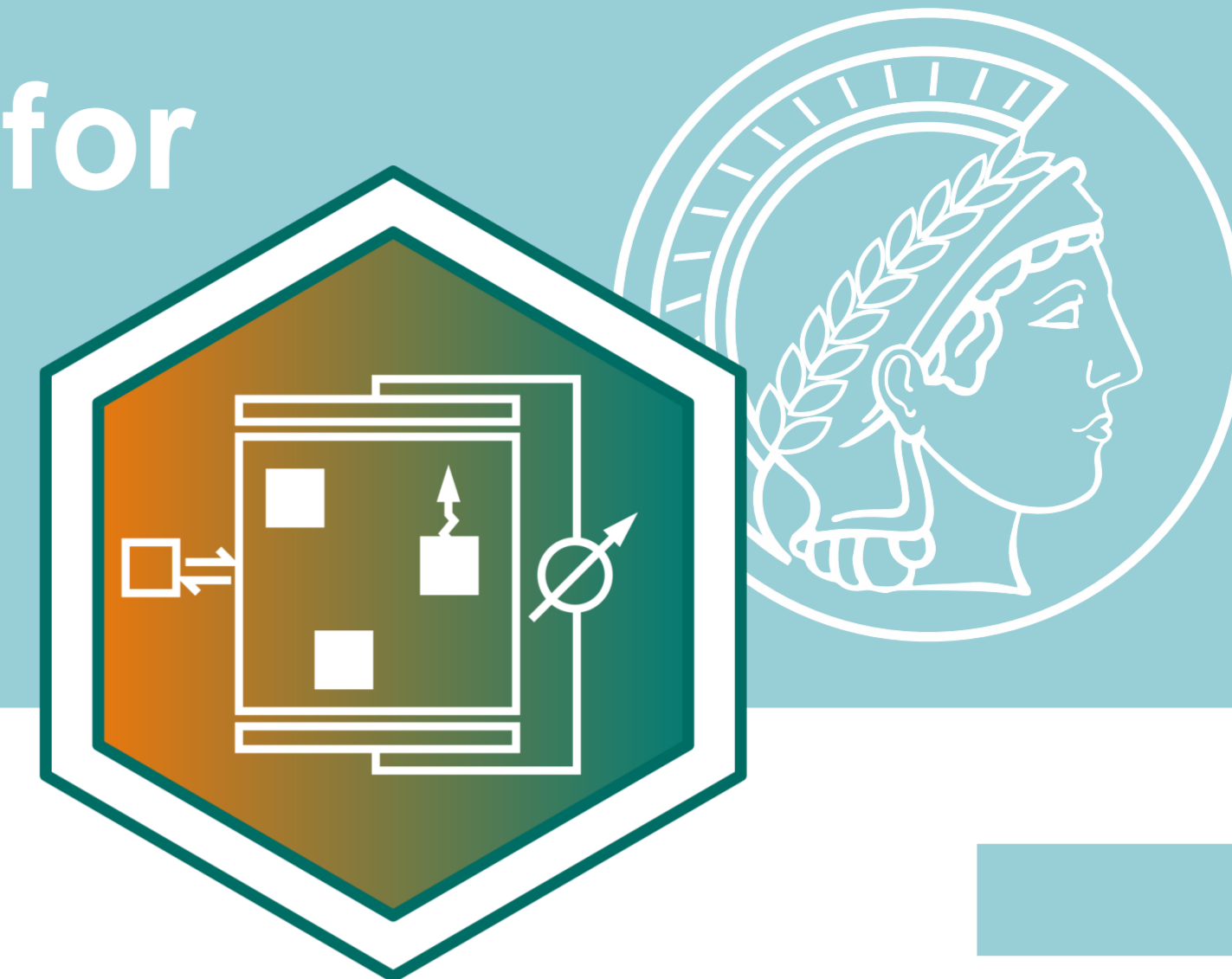


# Single Alkaline (Li<sup>+</sup>, Na<sup>+</sup>) Ion Conducting Polyelectrolytes for Battery Applications: Solvation and Dissociation Issues

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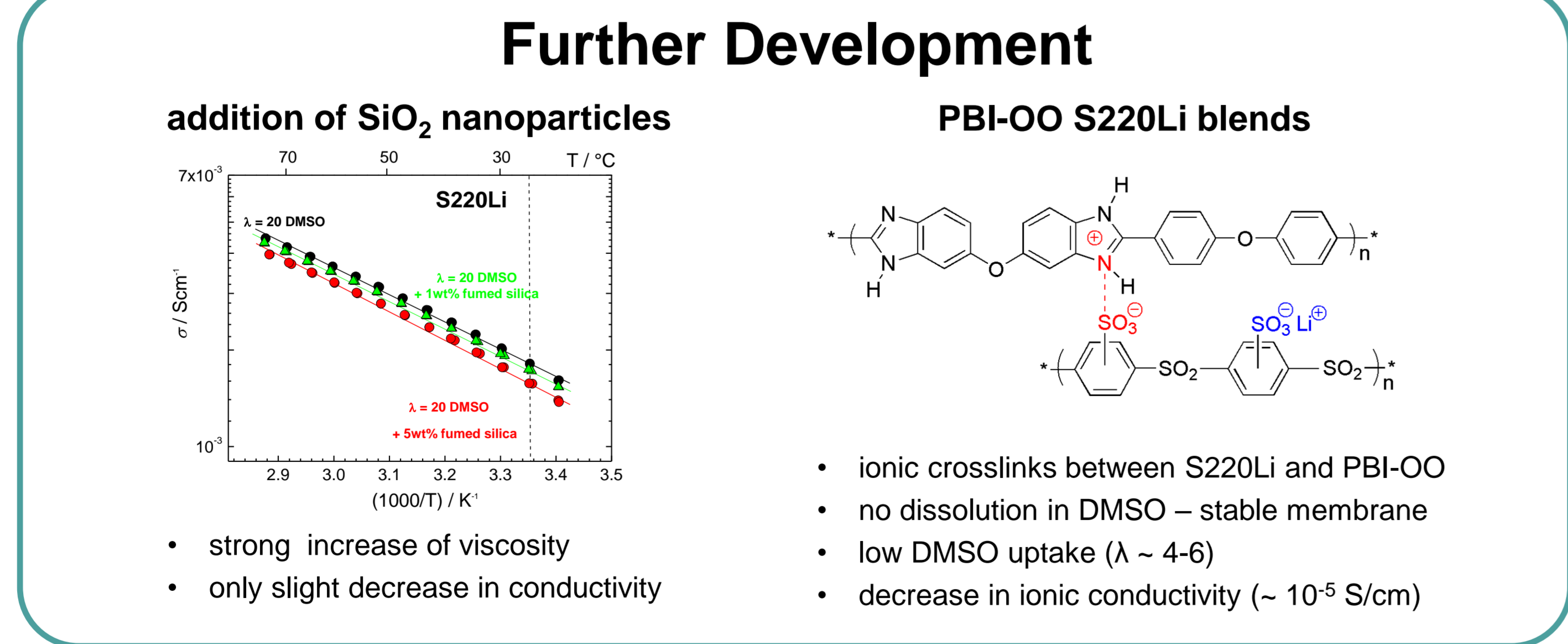
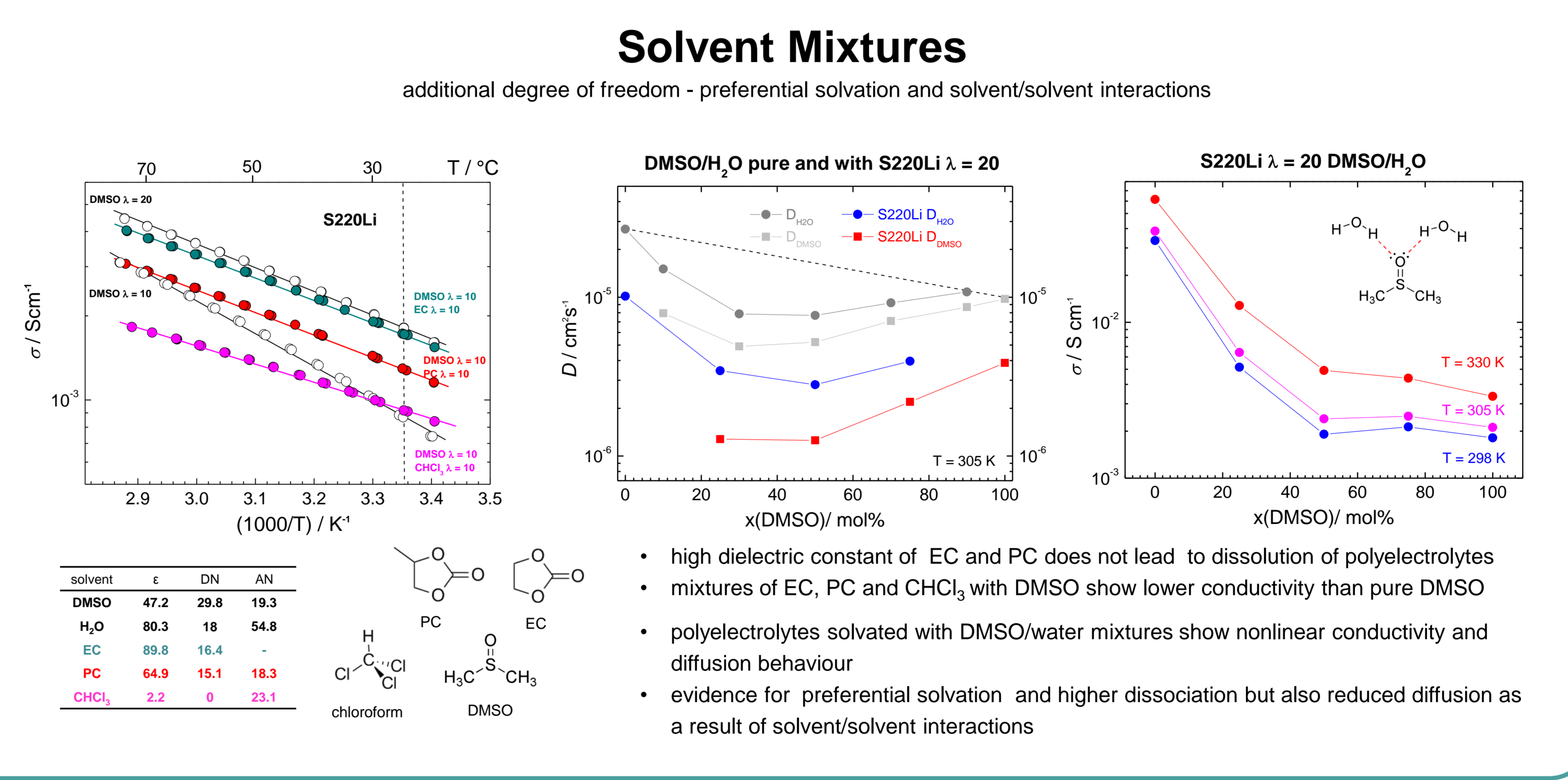
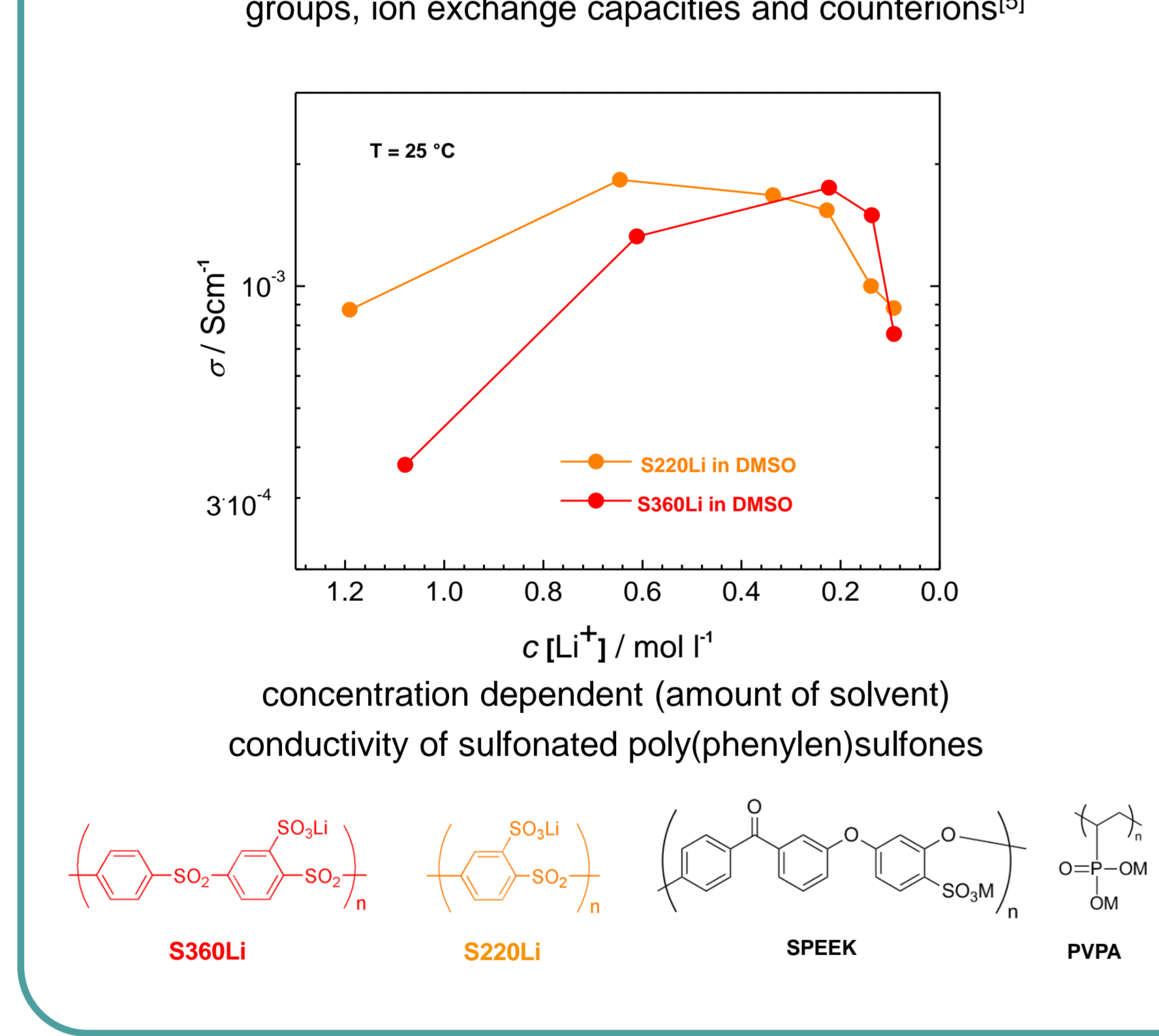
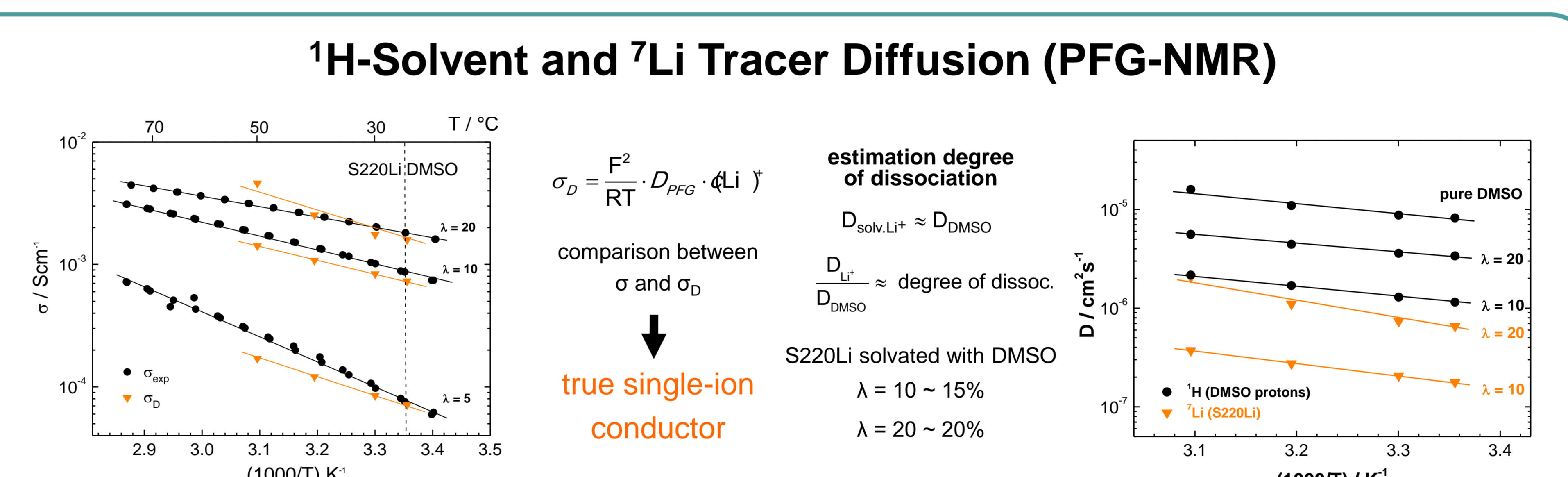
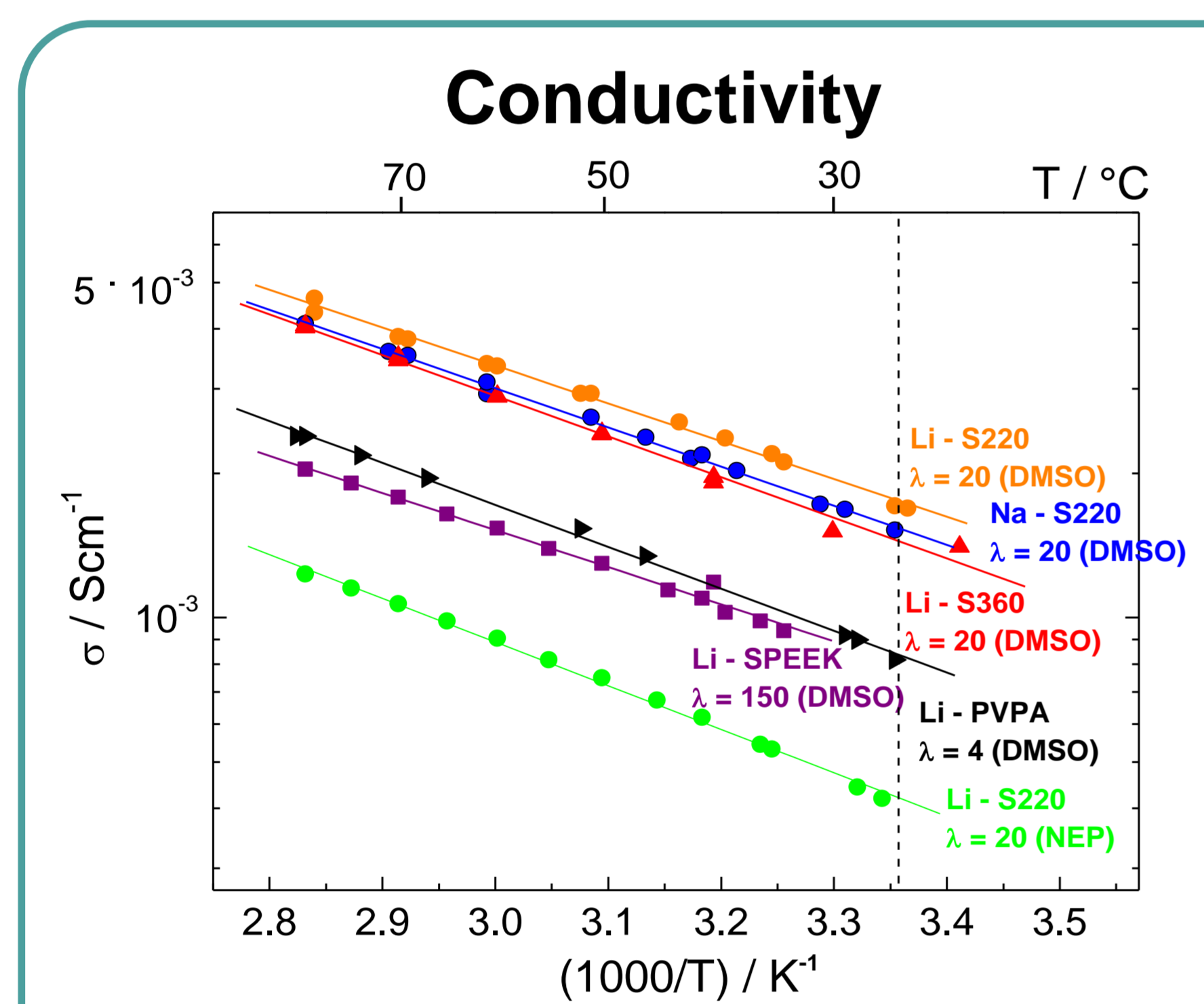
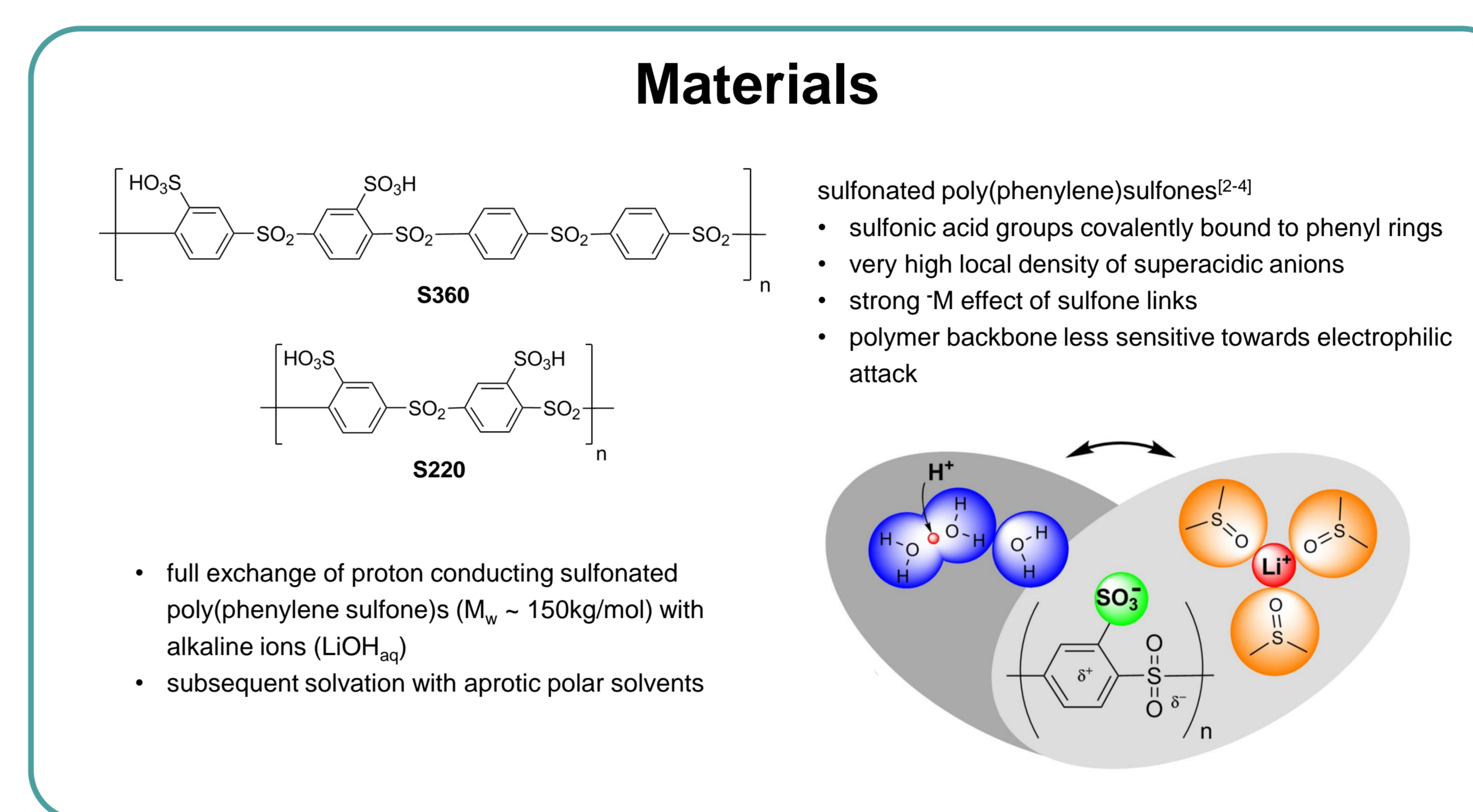
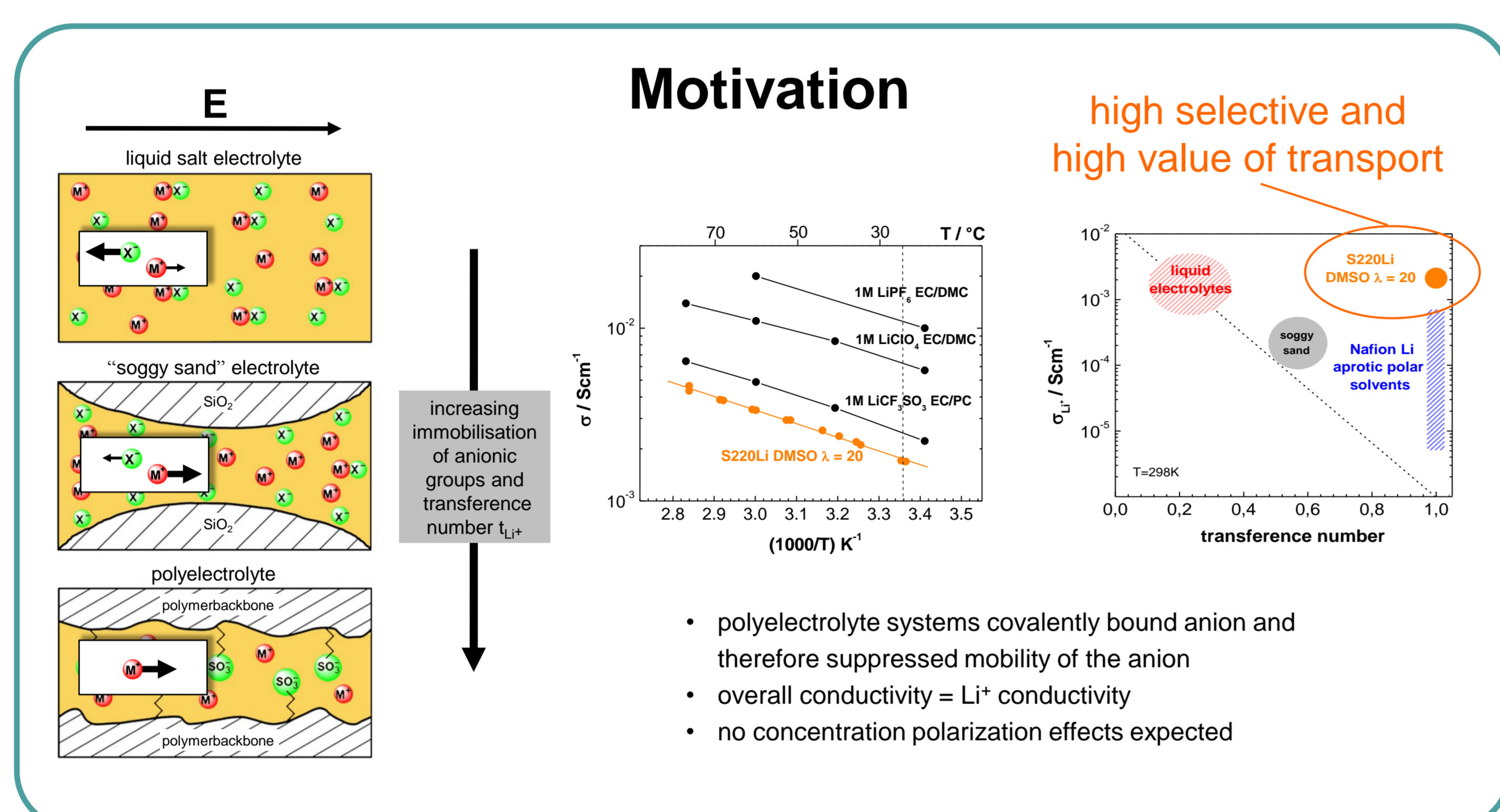


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## Abstract

Electrolytes in lithium-ion-batteries are commonly solutions of salts in aprotic polar solvents. Ionic conductivity in these systems has large contribution from anion mobility, while the lithium-ion transference number is generally smaller than 0.5. Especially for high-drain battery applications this can lead to concentration polarization effects<sup>[1]</sup> in porous electrode structures and therefore decrease the electrical performance. Single-ion conducting polyelectrolyte systems can overcome this problem by covalently binding the anions and therefore suppressing their mobility. This high selectivity going

along with high values of conductivity makes them a promising electrolyte for battery applications. Here the influence of the kind of solvent (solvation energy, coordination number and in particular specific (chemical) interactions) on the charge carrier formation and mobility are examined. In addition, not only the ionic conductivities but also the coupling of the ionic motion to the solvent dynamics is studied. Examples will be given for different solvated polyelectrolytes with lithium-single ion conductivities approaching these of salt-containing liquid electrolytes.



### Conclusions

- clue for obtaining high Li<sup>+</sup>- conductivity: very high local density of superacidic anions
- moderate solvating properties of aprotic solvents leave significant residual ionic interaction between functional group and counterion as evidenced by low degrees of dissociation (still space for optimization)
- solvation and dissociation not only controlled by the solvent's dielectric constant
- influence of specific chemical interactions between solvent, cation, anion and backbone
- solvent mixtures provide an additional degree of freedom for identifying these interactions
- potential to replace salt containing liquid battery electrolytes
- solvated polyelectrolytes combine: high selectivity and high value of conductivity

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