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Compatibility of pyrrolidinium-based ionic liquid electrolytes with manganese oxide cathodes materials in lithium batteries

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The quest for the development of rechargeable lithium-metal batteries has attracted vigorous worldwide research efforts because this system offers the highest theoretical specific energy [1]. For this to be achieved, the repetitive deposition and stripping of lithium must be close to fully reversible. Thus, alternative electrolytes have been investigated, such as the room-temperature ionic liquid (RTILs). Lithium can be cycled with a high degree of reversibility with efficiencies exceeding 99% using systems based on N-methyl N-alkyl pyrrolidinium (P_{1X}^+) combined with the TFSI anion [14]. More recent efforts have been directed towards systems based on P_{1X}^+ cations with the FSI anion and appear to be even more promising. However, although these two systems seem to be stable against lithium, their compatibilities with cathode materials require full assessment as well. In this work, we discuss to what extent RTILs based on P_{1X}^+ cations with TFSI or FSI anions can be used as electrolytes for rechargeable Li batteries using various manganese oxides cathodes. Strategies to minimize cathode dissolution are also debated, such as the substitution of part of the manganese with titanium.