Polymeric Schiff-Bases as Negative Electrodes for Low Cost Sodium ion Batteries

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Energy storage is becoming of major importance in order to balance the intermittency of renewable energy sources which are needed to satisfy the increasing energy demand of current societies. Lithium ion batteries have been studied for more than 30 years and are still the subject of numerous research works. Lower cost alternatives, such as sodium ion batteries (NIB) are an attractive solution for large scale stationary applications such as grid storage. To meet the low cost requirement our research effort is focused on low cost, “scalable” anode materials.

We will present and discuss our results related with the electrochemical activity of Schiff bases in NIB. First we will show that the redox entity comprising two Schiff base groups attached to a phenyl ring (–N=CH-Ar-HC=N-Ar) is active for sodium ion storage (Ar: aromatic). Electroactive polymeric Schiff bases are produced by reaction between non-conjugated aliphatic or conjugated aromatic diamine blocks with terephthaldehyde unit. Crystalline poly-Schiff bases are able to electrochemically store more than one sodium atom per azomethine group at potentials between 0 and 1.5 Volts vs Na+/Na which make them suitable negative electrode materials. The redox potential is tuned through conjugation of the polymeric chain and by electron injection from donor substituents in the aromatic rings. Reversible capacities of up to 350mAh/g are achieved when the carbon mixture is optimized with Ketjen Black®. Interestingly, the “reverse” configuration (–CH=N-Ar-N=HC-Ar) is not electrochemically active, though isoelectronic.

References:
