Improving Electrochemical Performance of $Li_{1.2}Mn_{0.52}Co_{0.13}Ni_{0.13}O_2$ by Surface Nitrogen Doping via the Plasma Treatment

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In order to further discuss the effect of surface nitrogen doping, the diffusion coefficient of Li^+ can be calculated from the EIS plots (Fig.4b) in the the Warburg region using the following equation:

$$Z' = Rs + Rct + \sigma\omega^{-0.5} \qquad (1)$$

$$D = R^2T^2 / 2A^2n^4F^4C^2\sigma^2 \qquad (2)$$

where R is the gas constant, T is the absolute temperature, A is the surface area of the cathode electrode, n is the number of electrons per molecule during oxidization, F is the Faraday constant, C is the Li^+ concentration, and σ is the Warburg factor associated with Z_{re}. Due to Z' is proportional to $\sigma\omega^{-1/2}$, the value of σ can be obtained by linear fitting of the relationship plot Z' - $\omega^{-0.5}$ (Fig. S1). According to equation (1, 2), the apparent diffusion coefficient D_{Li} can be obtained.

The diffusion coefficient of Li^+ in pristine is 5.16×10^{-15} $cm^2\cdot s^{-1}$, while that of the P1 is 1.49×10^{-14} $cm^2\cdot s^{-1}$. Obviously, the diffusion coefficient of Li^+ is greatly improved due to the surface nitrogen doping.

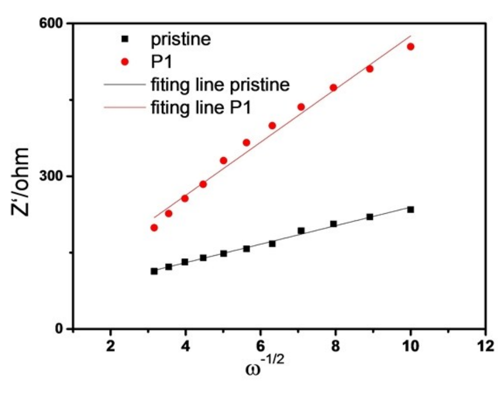

Fig. S1 Z'-$\omega^{-0.5}$ pattern in the low-frequency region obtained from EIS measurements of pristine and P1.