Effect of Stacked Structure of GO and MMT composite on Proton Pathways in Proton Exchange Membranes

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Fuel cell membranes are crucial for proton conductivity, which directly impacts fuel cell performance. Recent studies have focused on improving proton conductivity and mechanical properties by incorporating fillers like graphene oxide (**GO**)[1]and montmorillonite (**MMT**)[2] clay into polymer membranes. These fillers enhance proton conductivity through their unique structures and ability to increase water uptake. However, the alignment and orientation of the membrane's internal structure, a key factor in proton pathway efficiency, have been largely overlooked. This study addresses this gap by investigating how the stacked arrangement of **GO** and **MMT** fillers influences proton conductivity.

Two types of membrane structure were fabricated using the solution casting technique with identical filler ratios: one employing a layer-by-layer (**LBL**) assembly method and the other incorporating fillers directly blended into the polymer matrix. Electrochemical impedance spectroscopy revealed that the LBL-assembled membrane exhibited a significantly higher proton conductivity of 0.319 S/m, compared to 0.078 S/m for the blended membrane **Fig.1(a,b).** This result underscores the critical influence of structural alignment and filler orientation on proton transport efficiency within the membrane. The study introduces a novel approach by demonstrating that controlled, ordered assembly of fillers, as achieved through **LBL** fabrication, can markedly enhance proton conductivity and overall membrane performance.

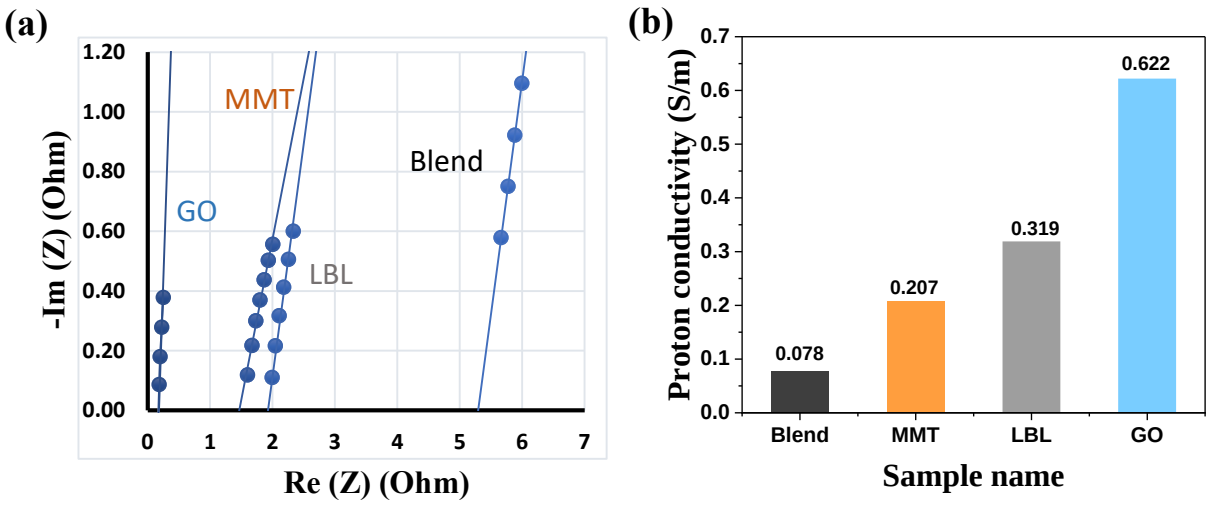

Figure 1: (a) impedance measurements results, **(b)** proton conductivity for different membranes.

References:

[1] Meng, *Ziyi, et al. ACS Applied Energy Materials* 6 (**2023**) 1771-1780.

[2] Wang, *Bei, et al. ACS Applied Nano Materials* 6 (**2023**) 20355-20366.