Pressure-independent through-plane electrical conductivity measurements of conductive polymer composites

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Polymer composites with high contents of carbon fillers such as graphite are commonly used as bipolar plates in HT-PEM fuel cells due to their useful electrical properties. The commonly used method for evaluating the through-plane electrical conductivity (σ_{tp}) of bipolar plates applies a carbon paper, e.g. a gas diffusion layer (GDL), to ensure improved electrical contact between the electrodes and sample under a compressive load [1-4]. However, due to the roughness of most bipolar plate (BPP) surfaces, the measured σ_{tp} is dependent on the magnitude of the compressive load which complicates comparisons of results obtained by different laboratories [5]. As a result, a new method, independent of applied pressure, is proposed for measuring σ_{tp} by applying a gallium-indium (EGaIn) eutectic alloy as liquid electrodes, see figure 1 (left). The accompanying setup is low-cost in terms of equipment, and it is uncomplicated to assemble. The preliminary results reported in figure 1 (right) indicate a 3-5 times higher measured σ_{tp} using EGaIn as contact material in contrast to GDL contacts at even moderate pressures of 20 bar. This has been interpreted to originate from a lowered contact resistance between BPP and contact material.

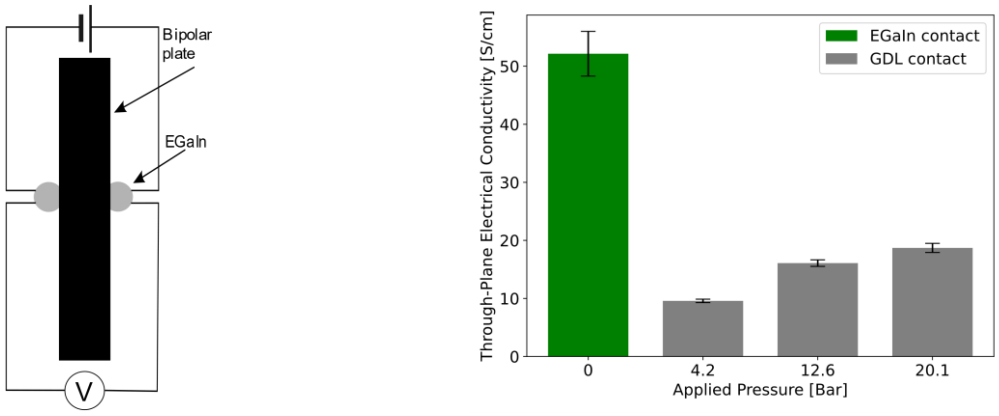

Fig. 1: *Left* Schematic of the setup. *Right* Measured through-plane electrical conductivities of graphite-filled polymer composite bipolar plates using a gallium-indium eutectic alloy (EGaIn; green) and gas diffusion layers (GDLs; grey) as contact materials. Error bars show the standard deviation.

References

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