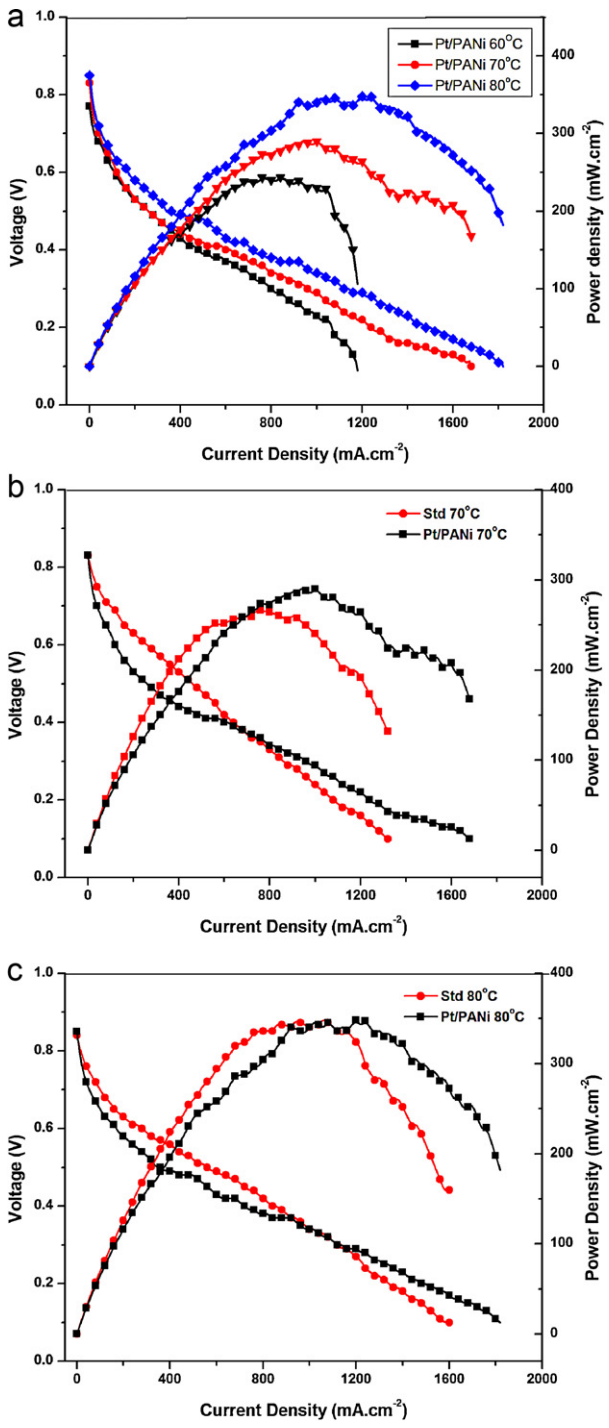

Fig. 14. (a) Fuel cell performance of Pt–PANi coated GDL using H_2/O_2 at various temperatures. (b) Fuel cell performance with and without Pt–PANi coated GDL using H_2/O_2 at 70 °C. (c) Fuel cell performance with and without Pt–PANi coated GDL using H_2/O_2 at 80 °C.

performance of the cell with Pt/PANi thin layer coated GDL and that with the standard MEA at 70 °C and 80 °C, respectively. It could be observed that Pt/PANi layer improved the performance especially at high current density values even though the overall platinum content of the Pt/PANi based MEA is lesser than that of the reference. The performance of the Pt/PANi coated GDL at 70 °C (Fig. 14b) falls behind that of the reference MEA at low current densities. Similar trend is observed at 80 °C also (Fig. 14c), but with lesser deviation in performance at low current densities compared to that at 70 °C. This is due to the fact that at low current densities, the polarization losses are mainly due to the oxygen reduction reaction which is kinetically sluggish and the losses decrease when the current is increased [23] and also due to water management issues at low current densities. In addition, the lesser amount of Pt in the Pt/PANi coated GDL could have been insufficient to pull up the sluggish kinetics in the low current density region (<600 mA cm^{-2}). Nevertheless it widens the useful current density ranges beyond that by the reference MEA with high Pt loading. Therefore it would be useful in systems requiring momentary and continuous high current densities such as in automotive applications. The same trend of widening the useful current density range is observed from the performance curves at 80 °C (Fig. 14c), which also confirms the usefulness of the Pt/PANi layer on the GDL. The peak power of the reference MEA (5 cm^2) is about 1250 mW while that of Pt/PANi coated MEA of the same area (but with 18.5% less of Pt) is 1450 mW at 70 °C. Further optimization of the interphase and GDL for higher power density is in progress.

4. Conclusions

A performance boosting interphase with Pt/PANi was introduced in the electrode assembly of proton exchange membrane fuel cell and evaluated. Conducting polyaniline was used as support onto which platinum was deposited by a simple wet chemistry method. The microporous structure of PANi facilitated not only the large useful surface area of the platinum but also its dispersion on PANi by the charge interaction. The thin layer of Pt/PANi on GDL improves the cell performance at high current densities in spite of lesser loading which is attributed to the increased capacitative current of Pt/PANi layer in the presence of O_2 thereby improving the kinetics of subsequent reduction of O_2. Chemical stability of PANi is proved by its performance at 80 °C and its electrochemical stability is proved by the featureless CV plots. Continuous matrix of PANi with large flow channels could provide an ideal surface for the three-phase equilibrium between catalyst, fuel and oxidant gases, and product water. The increase in performance is attributed to the increased capacitative current of Pt/PANi layer in the presence of O_2 thereby improving the kinetics of subsequent reduction of O_2.

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