The performance of N112 Nafion membrane was exhibited best performance at saturation humidity at all temperature range in this study. While composite membrane was performing better than Nafion membrane at 40%relative humidity. The best performance among all these membrane was a composite NS15W.

It was observable that the presence of inorganic compounds in the Nafion cluster may create a capillary condensation that making the composite membrane has more hygroscopic properties in compare with Nafion membrane. The conductivity of the composit membrane stable at reduced relative humidity.

4. Conclusion

Nafion-PWA $-SiO_2$ composite membrane was fabricated to improve the water-retention ability of the membrane with the assistance of the hydrophilic capillary. The PWA-SiO_2 was characterized to be ordered meso-structure with pores size of 3.5 nm. The proton conductivity through the Nafion-PWA-SiO2 composite membrane has little change under elevated temperature and low humidity. As a result, the Nafion-PWA-SiO_2 composite membrane (NS15W), presented a steady performance under 90°C, 40 % RH. The power of the cell assembled with Nafion-PWA-SiO_2 composite membrane reached a peak value of 2.66 Watt, which is much higher than pure Nafion membrane.

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