

2<sup>nd</sup> International Conference on

# Battery and Fuel Cell Technology

July 27-28, 2017 | Rome, Italy

## Fuel cell performance of SPEEK-PEG-PWA composite membrane

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Proton exchange membrane fuel cell (PEMFC) is promising technology for clean and efficient power generation in the 21<sup>st</sup> century. Currently perfluorinated membranes are used as electrolyte that have high cost and complicated synthesis process which limits the commercialization of the PEMFC. Hydrocarbon polymers are good alternative for membranes and during last few decades research has been concentrated on that. The present work focuses on the development of composite membrane by using a thermoplastic polymer, partially sulfonated polyether ether ketone (SPEEK) and polyethylene glycol (PEG) as cross-linker along with varying amount of phosphotungstic acid (PWA) as an inorganic additive. The membranes are prepared using sulfonated PEEK with an ion exchange capacity of 2 meq/g and 33% of PEG having molecular weight of 600 Da was used as cross linker, the amount of PWA was varied from 5 to 50%. Among the various concentration of PWA in membranes, the 10 wt% PWA gave highest conductivity (90 mS/cm), less swelling and good stability in water up to 60°C. The fuel cell performance of these membranes was measured using a 25 cm<sup>2</sup> membrane electrode assembly made using commercial carbon paper based electrode (0.2 mg/cm<sup>2</sup> Pt loading). The cell performance tests were carried out (H<sub>2</sub>/O<sub>2</sub> at 2 bar pressure) at 30 and 60°C (Figure 1). The maximum power density obtained at 30°C was 75 mW/cm<sup>2</sup> at current density of 200 mA/cm<sup>2</sup> and voltage 375 mV which increased at 60°C to 173 mW/cm<sup>2</sup> at current density of 440 mA/cm<sup>2</sup> and voltage 400 mV. The cell gave stable performance after running for 40 hours at its maximum power. The present membrane performance is comparable with the reported value for commercial membranes (power density of 360 mW/cm<sup>2</sup> to 420 mW/cm<sup>2</sup> at 600 mV and 80°C). Hence, the SPEEK-PEG-PWA membranes can be an alternative solid polymer electrolyte for fuel cell.

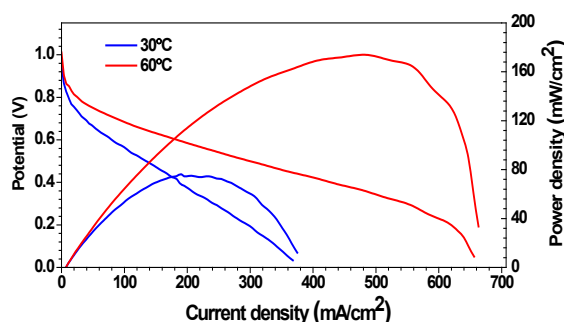


Figure 1: Polarisation and power density curves at 30°C and 60°C for SPEEK-PEG-10% PWA membrane

## Biography

Mamta Kumari is currently working as a Senior Research Fellow in the Membrane Development Section of Chemical Engineering Group at Homi Bhabha National Institute, India. She has expertise in the field of development of solid polymer electrolyte for electrochemical applications, e.g., fuel cells. Her studies are in the field of development of structurally modified membranes with high conductivity.

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