Preparation solution as imp regnant of the membrane.
0.45 gr. PWA crystal dissolve in the mixture of 1.04 gr Deionized water and 3.0027 gr Iso Propyl Alcohol (IPA). To the mixture was added 0.257 gr. Tetra Ethoxy Ortho Silicate (TEOS) and mixed using magnetic stir for 3 minute to produce homogeneous solution.

Impregnation of the membrane Nafion 112 in the solution.
Membrane is impregnated in the solution for 10 minute and than dried in room condition for 10-15 minute. Catalyst layer forming composition applied onto both surface of the impregnated membrane using brushing method to produce membrane-electrode (ME). After word ME is dried in room temperature for 10-15 minute and gas diffusion layer imposed on both surface of the membrane-electrode than drying is continuously in vacuum oven at temperature 80^0 and 25 mmHg for 30 minute.

Preparation Membrane Electrode Assemblies (MEA).
The membrane electrode assemblies (MEA) was prepared by hot pressing the GDE/ME/GDE sandwich (active area of electrode 50 cm^{-2}). Hot pressed done at constant temperature at 120^0C and at a pressure 30 atm for 4 minute produced membrane electrode assemblies (MEA). MEA was positioned in single cell test, which was then installed in the fuel cell test system (Arbin Fuel Cell Test System). The test station is equipped with the temperature, pressure, flow rate controller for fuel gas (H_2) and oxidant (air). Humidification system is used to make fuel and air in saturation condition.

Fuel cell test
Performance evaluation of the PEMFC use feed fuel is pure hydrogen and air as oxidant at atmospheric pressure and certain temperature. The flow rate of fuel equal 300 ml/minute while air flow rate is 600 ml/minute. Cell potential vs. current density measurements were then made under this condition.

Result and Discussion
Tungstophosphoricacid $H_3[P(W_3O_{10})_4]$ (PWA) is an Heteropolyacid (HPA) with high conductivity, this will enhance membrane conductivity The basic structural unit of PWA is the Keggin anion $(PW_{12}O_{40})^{3-}$ which consists of the central PO_4 tetrahedron surrounded by four W_3O_{13} sets linked together through oxygen atoms. These complex form channels, which can contain up to 29 water molecules in different hydrate phases. This variety leads to different protonic species and hydrogen bonds of different strength. The consequence is high proton conductivity at room temperature at around 0.18 S/cm/ Lower hydrates of PWA containing six water molecules are stable up to 180 ^{0}C an important.

Immobilized of heteropolyacid in silicate matrix is very important due to PWA have big molecule size and very soluble in polar solvent. The main reason that HPAs are widely used is that their molecule sizes are extremely large. The structure of an anion of an HPA with Keggin structure is close to a sphere with a diameter of about 1 nm. If PWA could be formed like a" ship in a bottle" in a" cage, who's size is slightly larger than their anions, the HPA anions would not be able to diffuse out of the cage [10].

Fuel Cell Test the System (FCTS)
Analyze the catalyst activity for various concentration have been conducted by using Fuel Cell Test System at certain temperature stoichiometry between hydrogen and oxidant. The result is compared to commercial MEA at the same operation condition. Current density Vs time curve for various catalyst loading depict by figure.1. While Figure 2 show the stability of the polarization curve for the catalyst loading 0.43 mg/cm^2 during 45 hour. Figure 3 show . Current Vs Time of the sol-gel MEA (Pt loading 0.38/0.38 mg/cm2 at the anode .and cathode)and Commercial MEA (Pt loading 0.38/1 mg/cm2 at anode/cathode) at room temperature.