CHAPTER V
CONCLUSIONS

The SPSF and SPVDF were sulfonated with the concentrated sulfuric acid (98%). The DS of sulfonated polymers increased with increasing the ratio of mol (acid/polymer) and sulfonation reaction temperature. The increase in DS induced increasing water uptake, IEC, proton conductivity, and methanol permeability because of more hydrophilic pathways created by the sulfonic acid group. At the highest DSs of SPSF and SPVDF, they possessed proton conductivity values of 5.42×10^{-4} and 2.08×10^{-4} S/cm, respectively. The proton conductivity of the sulfonated polymers is, however, still lower than Nafion (7.49×10^{-04} S/cm). However, the methanol permeability values of SPSF at the highest DS and SPVDF were lower than Nafion by about 100 times (SPSF DS= 71%, 9.59×10^{-08}; SPVDF DS 12.34%, 5.23×10^{-10}cm^2/s; Nafion117 DS = 100%, 3.08×10^{-05} cm^2/s). The tensile strength of the sulfonated polymers decreased with increasing DS due the reduction in crystallinity via the sulfonation process. Thus, SPSF and SPVDF are potential PEM candidates in direct methanol fuel cell application because they possess better overall properties relative to Nafion.