

O14 | **Free volume of PVA/SSA proton exchange membrane studied by positron annihilation lifetime spectroscopy**

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Humidity control and water management in polymer electrolyte fuel cells (PEMFC) still remain one of highest importance for increasing the efficiency and development of fuel cell stacks. In this study, poly(vinyl alcohol) was crosslinked using 5-30 wt% sulfosuccinic acid (SSA) by a solution casting method and additional thermally crosslinked at 100°C. Ion exchange capacity (IEC) of the membranes were in the range of 1.093-2.064 mmole/g. The thermal stability of PVA/SSA solid membranes was studied by thermogravimetric analysis (TGA), and it was found that the thermal stability of the membranes improved with increasing SSA content. Positron annihilation lifetime spectroscopy (PALS) was used in order to study the change of total free volume and for distinguishing the void size distribution at different humidity. It was found that the free volume and the water uptake is strongly correlated. The mean void size, however, was found to be related to the mechanical strength of the membranes. In addition, it was found that up to a relative of 30 RH % the ortho positronium lifetime doesn't change significantly whereas it increases strongly with increasing humidity of more than 30RH% as shown in figure 1. Moreover we observe that the conductivity was found in the range 0.216–1.56 mS/cm depending on both the temperature and the SSA concentration.

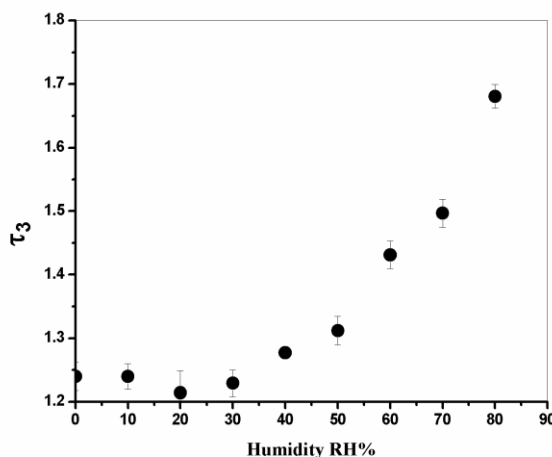


Fig.1. Ortho positronium lifetime τ_3 of PVA with 15% SSA membrane at different humidity.