Title: Study of free volumes in Nafion using positronium

Author: Lucie Košinová

Department: Department of Low-Temperature Physics

Supervisor: doc. Mgr. Jakub Čížek, Ph.D., Department of Low-Temperature Physics

Abstract: The object of this thesis is investigation of the absorption of water in Nafion and the influence of temperature on the absorption and desorption kinetics. Study of the absorption and desorption of water was carried out either measurement of changes in the macroscopic physical properties of Nafion (weighing, differential scanning calorimetry) either by microscopic characterization of the size distribution of free volume that arises as a consequence of an imperfect arrangement of polymer chains. For this purpose I used a non-destructive method used positron annihilation spectroscopy, which is currently the only technique capable of determination of the size distribution of free volumes having the free volume distribution by size of a few Å. The development of the size distribution and the concentration free volumes in the sample were determined on the based on the measurement of lifetime spectra of positrons annihilating in the sample of Nafion.

The results obtained in this thesis can be further used in research of Nafion, which is widely used as a semipermeable membrane during industrial chlor-alkali electrolysis and as a proton conductor in fuel cells.