

The thermal analysis of the swollen hydrogels obtained from LPEI by crosslinking

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Water in porous materials is classified into three different types: i) freezing water, with the properties of the bulk water, ii) freezing bound water, with different physical properties and iii) non freezing water, solvating backbone¹. The distribution of water between these states is important for many applications, such as enzymatic catalysis, permeability, drug solubilization and controlled release². DSC and TG are tools to study the behaviour of water encapsulated in porous materials. Organic hydrogels may also be classified as porous materials, thus the open question is whether the different states of water are observed too. A series of hydrophilic linear poly (ethyleneimine) hydrogels were prepared crosslinking LPEI with heptanedioic and dodecanedioic acids, poly (ethylene glycol) - and 1,4 butandiol - diglycidyl ether. The hydrogels swollen in water were investigated by DSC and TG analysis over wide temperature range in order to determine the phase transitions. Three states of water mentioned above were found to exist in the swollen hydrogels too. A significant difference between melting and freezing enthalpy was observed and explained. The amount of freezable water was determined as a function of the crosslinker, the degree of crosslinking and the heating rate. The model shown in Fig 1 based on experimental results has been proposed.

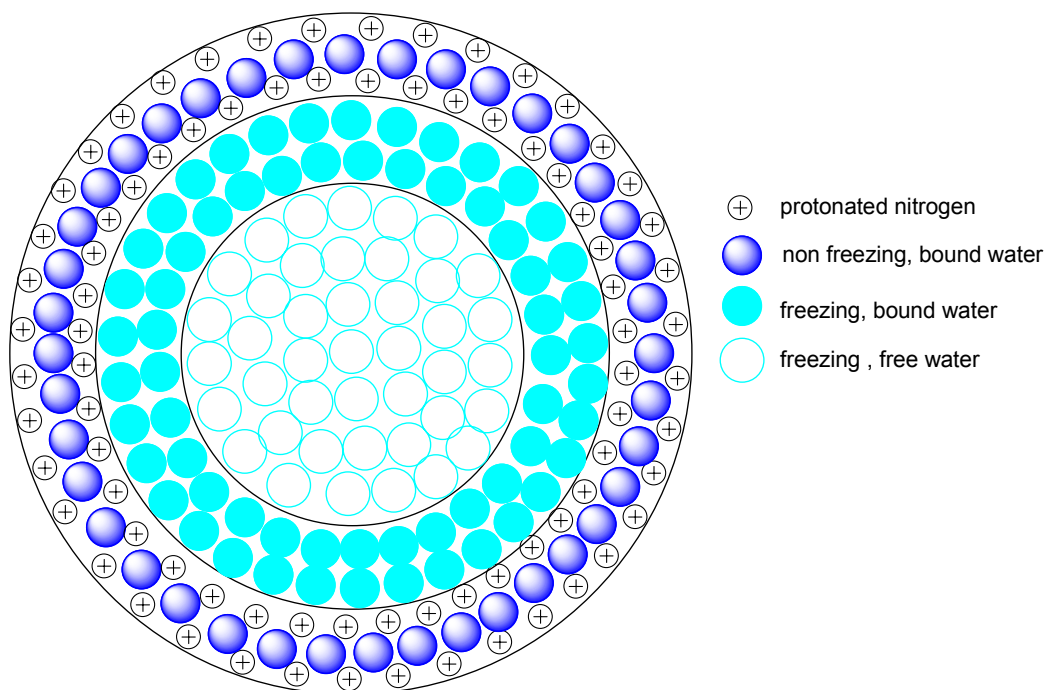


Figure 1 Model of distribution of water

¹ A. Shreiber, I. Ketelsen and G. H. Findenegg, Phys. Chem. Chem. Phys., 3, 1185, 2001.

² Q. Tian and et al, J. of Applied Polymer Science, 89, 1258, 2003.