STUDY OF THE INTERACTION OF WATER ON POROUS SILICON BY ENVIRONMENTAL SEM

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Abstract

Mesoporous inorganic materials, in particular porous silicon (PSi), have gained considerable attention due to their broad range of applications, ranging from different types of sensors, where the transduction may be electrical or optical, to optical coating of solar cells and biomedical applications, such as drug carrier material. These applications are derived from the versatility of PSi, which allows easy control over its pore size, morphology, and porosity during the fabrication process. These properties converge to structures exhibiting a high specific surface area (200-500 m2.cm-3). Vapor condensation or evaporation dynamics from PSi in response to variations in ambient conditions is especially relevant from the point of view of the protection of any PSi based device. Indeed, high humidity environment can affect their performance and reliability by changing their optical, electrical and/or mechanical properties. WetSTEM is the most common technique for the observation and the understanding of the water behavior in porous systems. It allows straightforward transmission observation of wet samples with good resolution. In this work, we studied and characterized the interaction of water with PSi using this technique. Therefore, we prepared planar sections of PSi to observe the pores in transmission mode. Dynamic experiments involving condensation and evaporation of water on PSi were carried out by choosing pressures and temperatures for non-equilibrium conditions. Additionally, the samples will be functionalized with different organic monolayers in order to tailor their surface properties, in particular, their wetting.

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