

Selective etching of silica layer using hydrofluoric acid for the understanding of internal structure of dye-silica complex

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Fluorescent dye-silica complexes have been widely used in both chemical and biological applications due to their unique fluorescent properties and photochemical stability. A variety of fluorescent dyes have been incorporated into silica network but the distribution of dye in the silica is not clearly understood. Some researchers suggested schematic models such as homogeneous, core-shell, single-layered, or multi-layered models. Although many schematic models have been suggested, they have not been verified experimentally. When the size of dye is small, dye cannot be visualized by electron microscopy. Here, a new method is proposed to locate dye molecules in silica nanoparticles by etching the outermost layer of nanoparticles using hydrofluoric acid (HF). The mode of incorporation is explained from the relationship between change of nanoparticle size and change of fluorescence emission intensity.