594c Inorganic-Organic Composite Membrane Structure for Selective Ion Transport

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Lipid membranes, incorporating ion channels, supported on ceramic membranes provides a novel way to impart various characteristics, such as high selectivity for ions, associated with cell membranes to the traditional ceramic membranes. These membranes have potential applications in pharmaceutical and chemical industries. They can serve as a model to understand various membrane processes on a stable, rigid and porous ceramic structure. We have designed a unique composite organic-inorganic membrane, both in spherical and planar geometry, to support lipid bilayer and to incorporate ion channels that facilitate selective flow of ions across this membrane. The structure consists of a mesoporous □-alumina supporting a microporous silica membrane, prepared through sol-gel process. A monolayer of octadecyltrichlorosilane was covalently attached on the surface of silica layer using surface silylation method which makes the surface hydrophobic. A lipid monolayer was deposited on octadecyltrichlorosilane stabilized by hydrophobic interaction. The alumina and silica layers were characterized by SEM and gas permeation measurements. Formation of hydrophobic octadecyltrichlorosilane has been confirmed by FTIR and water contact angle measurements. The flow of potassium and hydrogen ions were obtained by pH measurements and electrical resistance measurement for spherical and planar membranes, respectively. The results indicate that lipid layer deposited on octadecyltrichlorosilane forms a barrier to the flow of ions. The incorporation of Gramicidin increases the flow of ions through this barrier, which suggests its behavior as an ion channel in the composite inorganic-organic membrane structure.