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Catalytic palladium membrane reactors for one-step benzene hydroxylation to phenol

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Abstract

Pd membranes can be applied to many hydrogenation or dehydrogenation reactions for chemical production. Such membrane reactors can realize the simultaneous separation and reaction in one unit. However, the Pd membrane is easily poisoned by hydrocarbons or other impurities at high temperatures and itself does not provide sufficient catalytic efficiency. To overcome these problems, here we report a novel bifunctional titanium silicalite (TS) zeolite modified Pd capillary membrane microreactor for one-step hydroxylation of benzene to phenol. Using the state of art technology to uniformly anchor the monolayer of TS nanoparticles on the Pd membrane is still a challenge. In this work, the TS nanoparticles were attached the Pd membrane surface via a novel and efficient covalently bonding method using alkoxysilane linkers. The effects of various Pd membranes with different TS zeolite loading on the reaction efficiency and long-term stability were investigated. The benzene conversion and phenol yield