New Heat-Stable Large Pore Ti and Ti-Nb Oxides

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Introduction

We are developing a new class of porous transition metal oxides that are heat stable and are to be used as photocatalysts and solid supports. These materials are made at room temperature in solution by agglomerating titanium and niobium oxide particles and drying the products via supercritical point CO_2 solvent extraction. Despite their macro porosity, we have found these products to be highly heat stable and to possess random pore size distributions. A large part of the total pore volume comes from pores in the 50 to 300 nm range. We are trying to find optimal synthetic pathways that will lead to robust, lightweight, low density, highly porous materials, which can be used as high surface area photocatalysts and solid supports. The three dimensionally connected network of dense pore walls appear to give the solids good electronic conduction throughout the framework and good physical strength. The synthesis, characterization, and results from heat tests and the photolysis of water-borne contaminants will be presented.

Significance

The thermal stability of large pore transition metal oxides made via low temperature routes has been hindered by the tendency of these oxides to change from their amorphous states, created during sol gel or templated synthesis, into crystalline solids during heating. The structural changes that occur during crystallization result in pore collapse, loss of structural integrity, and diminished surface areas. We present here new materials syntheses, which result in high thermal stability, high crystallinity, high surface areas, and large pore structures.