Supplementary Information

Synthesis of High Strength Monolithic Alumina Aerogels at Ambient Pressure

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Experimental Section

Materials: Aluminum chloride hexahydrate ($AlCl_3$•$6H_2O$, Aladdin, AR), ethanol (EtOH, Aladdin, AR), deionized water, propylene oxide (PO, Aladdin, AR) and hydrochloric acid (HCl, Aladdin, AR) were used as raw materials. And the ATP was purchased from Jiangsu Jiuchuan Nano Materials Technology Ltd.

Preparation of ATP/alumina aerogel composite: The alumina sol was synthesized by dissolving 6.04g $AlCl_3$•$6H_2O$ as a precursor in 20 ml mixed solution of ethanol and deionized water (V_{EtOH}/V_{water}=7/3) with continues stirring. Then we operated as the following steps: (1) dispersing an appropriate amount ATP (heat treated at 300℃ for 3 hours) in the mixed solution (V_{EtOH}/V_{water}=7/3) to prepare homogeneous ATP suspension; (2) mixing the alumina sol and ATP suspension into uniform mixture; (3) preparing wet gel by dropping an quantitative propylene oxide (PO, Aladdin, AR); (4) aging and drying wet gel by ambient pressure drying method.

The ATP weight ratio was obtained through the following equation:

$$\omega = m_{ATP}/(m_{ATP} + m_{Al_2O_3}) \times 100\%$$

Here m_{ATP} and $m_{Al_2O_3}$ are the weight of ATP and alumina calculated from aluminum precursors.

Measurements and Characterization: The compressive experiments were conducted at a computer controlled electronic universal test machine, SANS CMT4503. The size of samples is d5mm×h10mm. Microstructure of the aerogels was studied using Sirion Field Emission scanning electron microscope (FEI SEM) and Tecnai G2 20 200KV scanning electron microscope (FEI TEM). The pore parameters of the aerogels were determined by low-temperature nitrogen adsorption measurements with an Tristar Ⅱ 3020 analyzer. FTIR spectroscopy was recorded as KBr pellets with a Nicolet740 spectrometer within a range of 4,000–400 cm^{-1} at a resolution of 4 cm^{-1} by 32 scans. Thermal analysis of samples was performed on differential scanning calorimetry–thermogravimetry analysis (DSC–TGA, $STAR^e$ System, METTLER TOLEDO, USA) in the temperature range of 50–800 °C at a heating rate of 10 °C/min under nitrogen. X-ray diffraction (XRD) measurements were performed using a D8-Discover diffractometer (Bruker, Germany) with Cu K_α radiation at room temperature from 10° to 80°. Thermal conductivity test was conducted on thermal conductivity meter (TC 3000E).

Table S1. Thermal conductivity of Al_2O_3 aerogel and ATP/Al_2O_3 aerogel composites

样品	导热系数（W/(m·K)）
纯 Al_2O_3 Aerogel	0.1556
ATP(26wt%)/Al_2O_3 Aerogel	0.1374

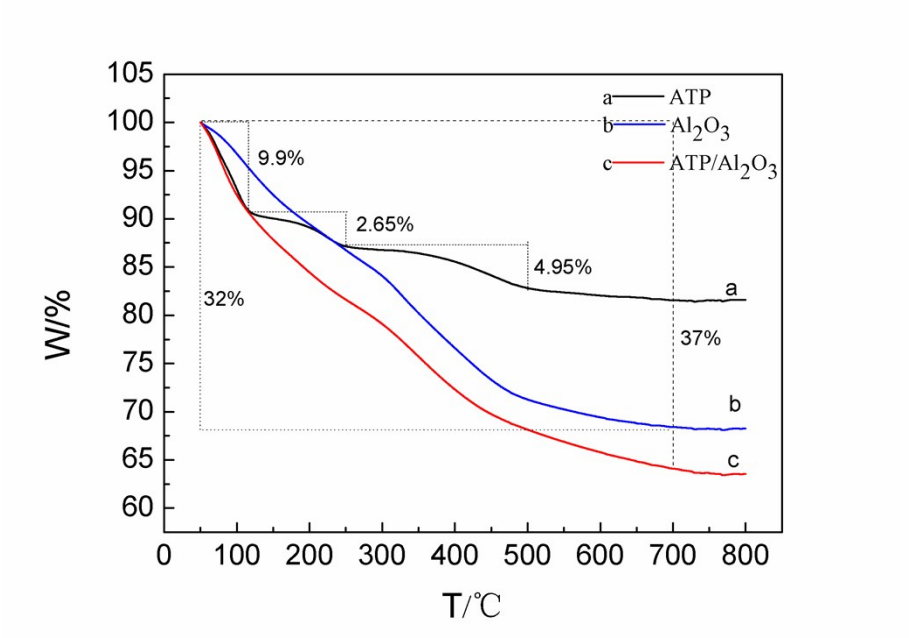

Figure S1. TGA curves of ATP (black line), ATP/Al_2O_3 aerogel (red line) and Al_2O_3 (blue line)

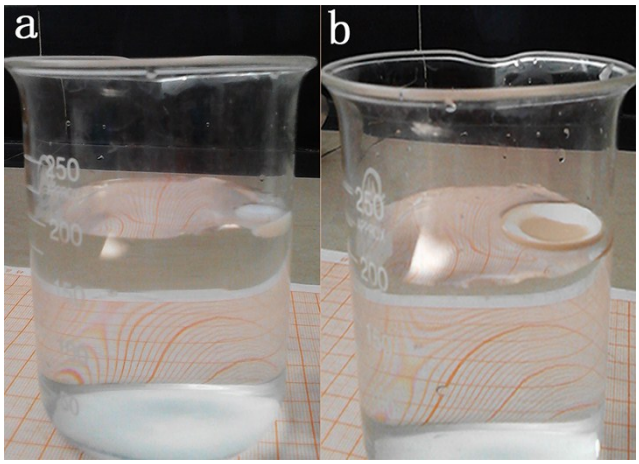

Figure S2. Images of samples floating on the surface of water: a). alumina aerogel prepared by organic solvent sublimation drying method (OSSD); b). ATP(26wt%)/Al_2O_3 aerogel prepared by ambient pressure drying.