Supporting Information

Materials and Chemicals

Thioflavin T (ThT) was purchased from Sigma-Aldrich. Aβ1-40 was obtained from American peptide. POMs were gifts from Prof Wang. All these reagents were used as received without further purification. Deionized water (18.2 MΩ cm) used for all experiments was obtained from a Milli-Q system (Millipore, Bedford, MA).

Synthesis of polyoxometalates.

The polyoxometalates used were synthesized according to procedures established by Key Laboratory of Polyoxometalate Science of the Ministry of Education (Northeast Normal University) and published elsewhere ($Na_5IMo_6O_{24}$, $H_3PMo_{12}O_{40}$ and $K_8[\beta\text{-}SiW_{11}O_{39}]$)[1-3]. As for $K_8[P_2CoW_{17}O_{61}]$, the preparation of $K_{10}[P_2W_{17}O_{61}]$ was exactly analogous to the procedure[4]. The compound was recrystallized from hot (70 ℃) water. $K_8[P_2CoW_{17}O_{61}]$ was prepared by the reaction of equimolar $[P_2W_{17}O_{61}]^{10-}$ and Co^{2+} in aqueous solution at 40 ℃ followed by the addition of excess KCl. The crude product was redissolved in water, reprecipitated, and finally recrystallized twice from hot water.

Aβ Preparation.

Aβ1-40 (lot no. U10012) was prepared as previously described. Briefly, the powered Aβ peptide was first dissolved in 1, 1, 1, 3, 3, 3-hexafluoro-2-propanol (HFIP) at the concentration of 1 mg/mL. The solution was shaking at 4 ℃ for 2 hours in a sealed vial for further dissolution and was then stored at -20 ℃ as a stock solution. Before use, the solvent HFIP was removed by evaporation under a gentle stream of nitrogen, and the peptide was dissolved in water.

Inhibition of Aβ aggregation with or without photo-irradiation.

Aβ monomers was incubated with POMs in 10mM Tris buffer (150 mM NaCl, pH 7.4) at 25 ℃ for 2h with or without irradiation using a UV lamp (365 nm, 5mW/cm^2), and the mixture was further incubated at 37 ℃ for 7 days.

Photodegradation of Aβ monomers and oligomers with photo-irradiation.

To a mixture of Aβ monomers and oligomers, which was prepared by incubation of Aβ monomers in Tris buffer at 37 ℃ for 24h, a solution of POMs was added. The mixture was then incubated at 25 ℃ for 2h under UV irradiation.

ThT Fluorescence Measurements.

The kinetics of Aβ aggregation was monitored by using the dye ThT, the fluorescence of which is dependent on the formation of amyloid fibrils. Fluorescence measurements were carried out with a JASCO FP6500 spectrofluorometer. The fluorescence signal (excitation at 444 nm) was recorded between 460 and 650 nm; 10 nm slits were used for both emission and excitation measurements. The peptide concentration was 1 μM, and the ThT concentration was 10 μM. At different times, aliquots of the Aβ solution were taken for fluorescence measurements.

Electrophoresis assay.

After incubation for 7 days, the samples were centrifuged at 13,000 rpm for 30 min. The supernatant (8 μL) was added with electrophoresis buffer (2 μL). Electrophoresis buffer consisted of SDS (5%, wt/vol), glycerol (27%, vol/vol), DTT (0.5%, wt/vol) and bromophenol blue (0.007%, wt/vol). Then samples were run on a 12% Tris-SDS gel at 100V for 2h, followed by silver staining.

Atomic Force Microscopy assay.

Atomic-force microscopy (AFM) measurements were performed using Nanoscope V multimode atomic force microscope (Veeco Instruments, USA). Samples for AFM images were diluted with deionized H_2O to yield a final concentration of 1 μM. Then the sample (20 μL) was applied onto freshly cleaved muscovite mica and allowed to dry. Tapping mode was used to acquire the images under ambient conditions.

DCF Fluorescence Measurements.

Different concentrations of POMs were diluted in water. After photo-irradiated for 15 min, DCFH-DA solution (20 μM) was added to the solution, and the mixture was incubated at 37 ℃ for 1h. Finally, the fluorescence intensity was monitored on a fluorescence spectrofluorometer with excitation and emission wavelengths of 488 and 525 nm, respectively.

Cell Toxicity Assays.

PC12 cells (rat pheochromocytoma, American Type Culture Collection) were cultured in Iscove modified Dulbecco medium (IMDM, Gibco BRL) supplemented with 5% fetal bovine serum and 10% horse serum in a humidified 5% CO_2 environment at 37℃. Cells were plated at a density of 10000 cells per well on 96-well plates in fresh medium. Aβ in the presence of different concentration of POMs were treated with or without photoirradition for 15 minutes and then co-incubated for 7 days before added to the cells. The cells treated with these Aβ samples were further incubated for 48 h at 37℃. Cytotoxicity was measured by using a modified MTT assay kit (Promega). Absorbance values of formazan were determined at 570 nm with an automatic plate reader.

[1] M. Filowitz, R. K. C. Ho, W. G. Klemperer and W. Shum, *Inorg. Chem.*, 1979, **18**, 93.

[2] H. Wu, *J Biol. Chem.*, 1920, **43**, 189.

[3] A. Tézé and G. Hervé, *J. Inorg. nucl. Chem.*, 1977, **39**, 999.

[4] P. Souchay, *Ions Minéraux Condensés*, p. 107. Masson, Paris (1969).

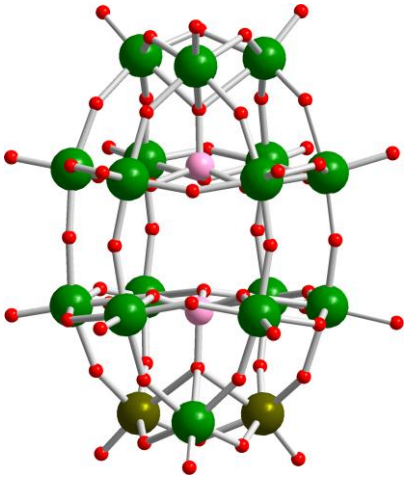

Figure S1 The structure of K_8 [$P_2CoW_{17}O_{61}$].

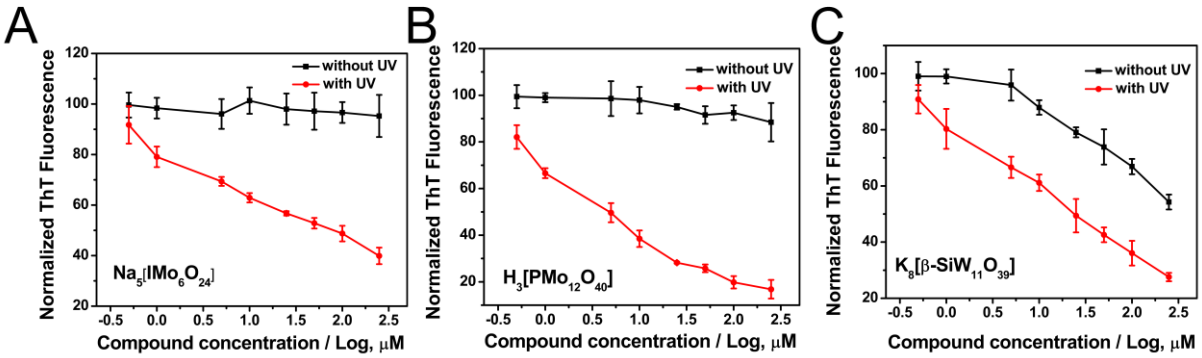

Figure S2 Dose-dependent inhibition of Aβ fibrillization by different types of POMs with and without photo-irradiation using ThT fluorescence assay. (A) $Na_5[IMo_6O_{24}]$; (B) $H_3[PMo_{12}O_{40}]$; (C) $K_8[\beta\text{-}SiW_{11}O_{39}]$. The concentration of Aβ was 50 μM.

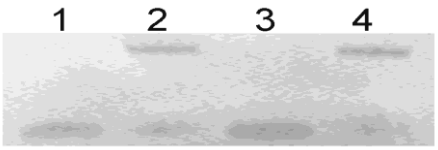

Figure S3 Determination of the effect of UV light on Aβ monomers and fibrils by SDS-PAGE. Lane 1) Aβ monomers, 2) Aβ fibrils, 3) Aβ monomers with UV irradiation, 4) Aβ fibrils with UV irradiation.

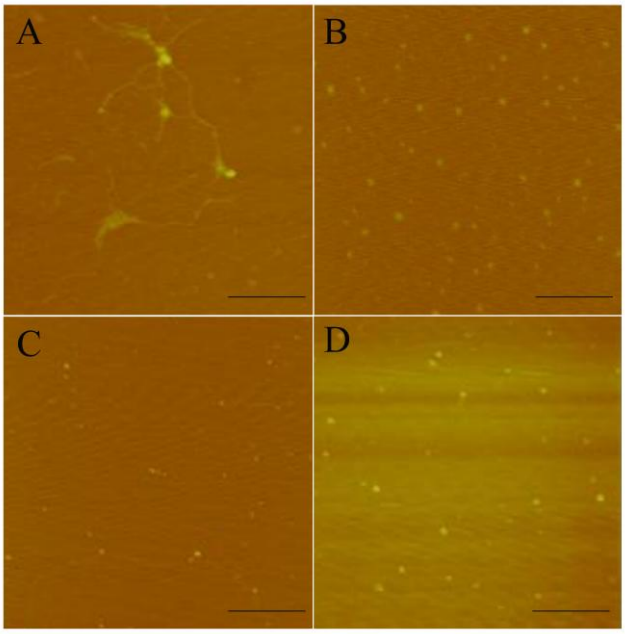

Figure S4 The morphology change of Aβ was analyzed by AFM images. A) Aβ fibrils. B) Aβ oligomers. C) Aβ oligomers in the presence of $K_8[P_2CoW_{17}O_{61}]$ under UV irradiation. D) Aβ oligomers treated with $K_8[P_2CoW_{17}O_{61}]$ upon UV irradiation were further incubated at 37℃ for 7 days. (Scale bars: 200 nm).

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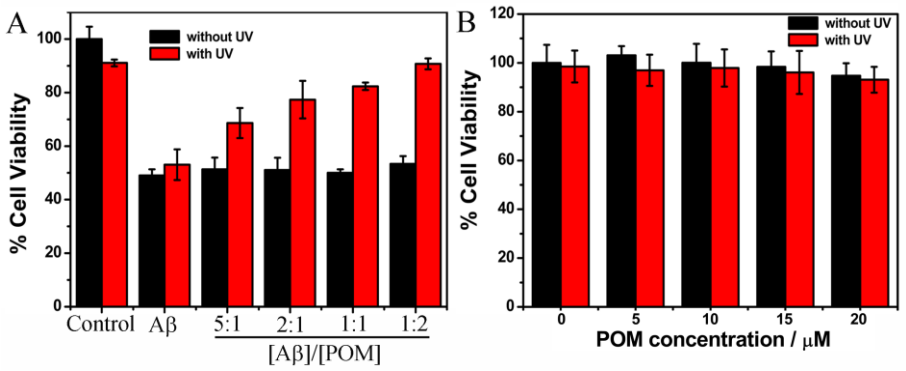

Figure S5 Effect of $Na_5[IMo_6O_{24}]$ on the cell toxicity of Aβ with or without photo-irradiation. Samples were prepared according to the Experimental Section in the presence (A) or absence (B) of Aβ (5 μM). The cytotoxic effect on PC12 cells was determined by using an MTT assay.

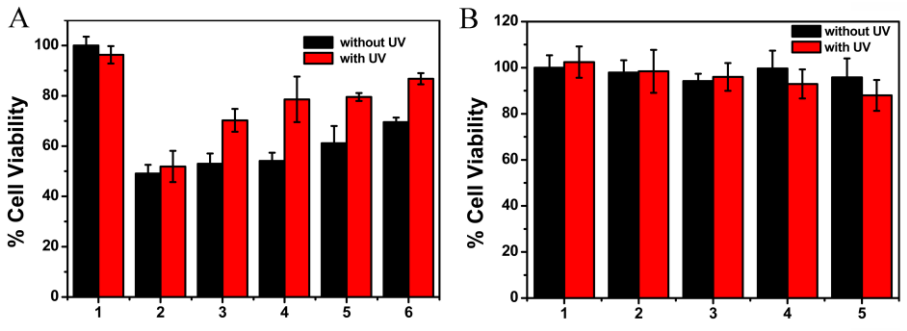

Figure S6 Effect of $K_8[\beta\text{-}SiW_{11}O_{39}]$ on the cell toxicity of Aβ with or without photo-irradiation. Samples were prepared according to the Experimental Section in the presence (A) or absence (B) of Aβ (5 μM). The cytotoxic effect on PC12 cells was determined by using an MTT assay.

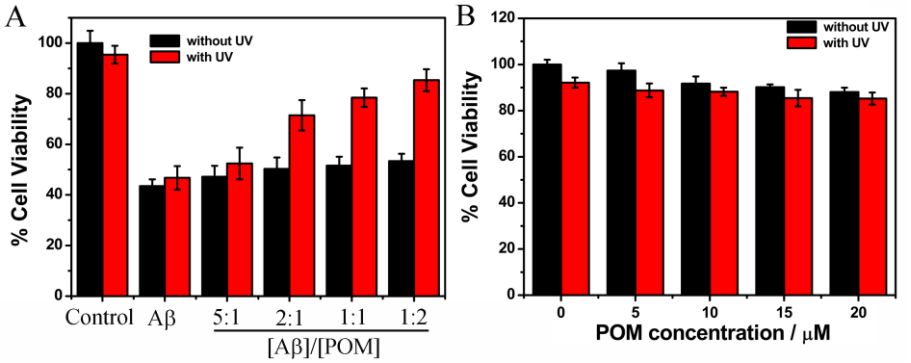

Figure S7 Effect of $H_3[PMo_{12}O_{40}]$ on the cell toxicity of Aβ with or without photo-irradiation. Samples were prepared according to the Experimental Section in the presence (A) or absence (B) of Aβ (5 μM). The cytotoxic effect on PC12 cells was determined by using an MTT assay.