



**Figure S1. Characterization of Al<sub>2</sub>O<sub>3</sub> particles.**

The morphology of Al<sub>2</sub>O<sub>3</sub> particles was observed using TEM (JEOL, JEM-2100F, Tokyo, Japan) and SEM/EDS (JEOL, JSM-7001F, Tokyo, Japan). For TEM, the dispersion of Al<sub>2</sub>O<sub>3</sub> particles was loaded on the formvar-coated copper grid and air dried. For SEM, powdered samples were loaded on a platinum grid and pretreated with Ar plasma at 10 mA for 60 sec in a Cressington sputter coater. The hydrodynamic size distribution of Al<sub>2</sub>O<sub>3</sub> particles was observed using a DLS spectrophotometer (Zetaplus 90, Brookhaven Instrument Co., USA).

The TEM images revealed clusters of Al<sub>2</sub>O<sub>3</sub> particles (less than 50 nm) with multiple morphologies, including circular, oval, hexagonal, and spindle-shaped. The morphologies observed by TEM images are in accordance with SEM images which also show clusters of Al<sub>2</sub>O<sub>3</sub> particles with multiple morphologies. The EDS mapping shows the presence of only aluminum and oxygen, confirming the purity of Al<sub>2</sub>O<sub>3</sub> particles. However, the average hydrodynamic size of Al<sub>2</sub>O<sub>3</sub> particles was observed as 1800.7 nm, and the polydispersity index (PDI) was 0.524. The hydrodynamic size of Al<sub>2</sub>O<sub>3</sub> particles is more than the size of the Al<sub>2</sub>O<sub>3</sub> particles as observed in TEM images, possibly due to the clusters of Al<sub>2</sub>O<sub>3</sub> particles.