Supplementary Information

Table S1. Engineered SiO_2, Au particle suspensions used for this study.

Manufacturer	Particle suspension	Nominal diameter (nm)	Density* (g/cm3)	Dilution factor to achieve 100,000 particles/mL
ThermoFisher Scientific	SiO_2	480	1.8-2.2	1,700,000
Bangs Laboratories	SiO_2	500	2.0	7,600,000
Bangs Laboratories	SiO_2	690	2.0	2,900,000
ThermoFisher Scientific	SiO_2	730	1.8-2.2	490,000
Bangs Laboratories	SiO_2	895	2.0	1,300,000
ThermoFisher Scientific	SiO_2	990	1.8-2.2	200,000
Bangs Laboratories	SiO_2	1,050	2.0	830,000
ThermoFisher Scientific	SiO_2	1,570	1.8-2.2	49,000
Bangs Laboratories	SiO_2	2,060	2.0	110,000
Bangs Laboratories	SiO_2	3,170	2.0	30,000
Bangs Laboratories	SiO_2	5,010	2.0	8,000
BBI Solutions	Au	60	19.3	460,000
Nanocomposix	Au	80	19.3	97,000
BBI Solutions	Au	100	19.3	99,000
Nanopartz	Au	150	19.3	18,000
Nanopartz	Au	500	19.3	6,800
Nanopartz	Au	500	19.3	280
Nanopartz	Au	1,000	19.3	35
Nanopartz	Au	1,500	19.3	12

* provided by manufacturer

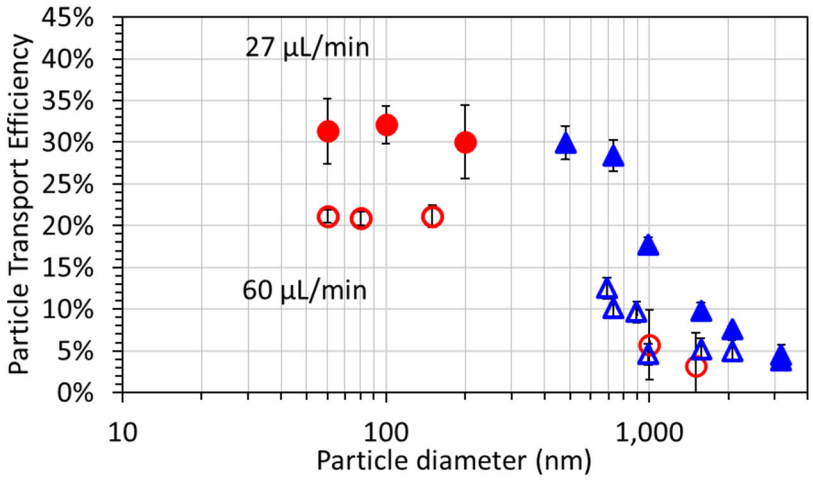

Fig. S1. Transport efficiency of engineered Au (●), and SiO_2 (▲) NPs and µPs as a function of the particle diameter (nm) of each particle measured by spICP-QMS at using an uptake rate of 27 µL/min (filled symbols) and 60 µL/min (open symbols). Error bars indicate +/- one standard deviation of three measurements of transport efficiency.

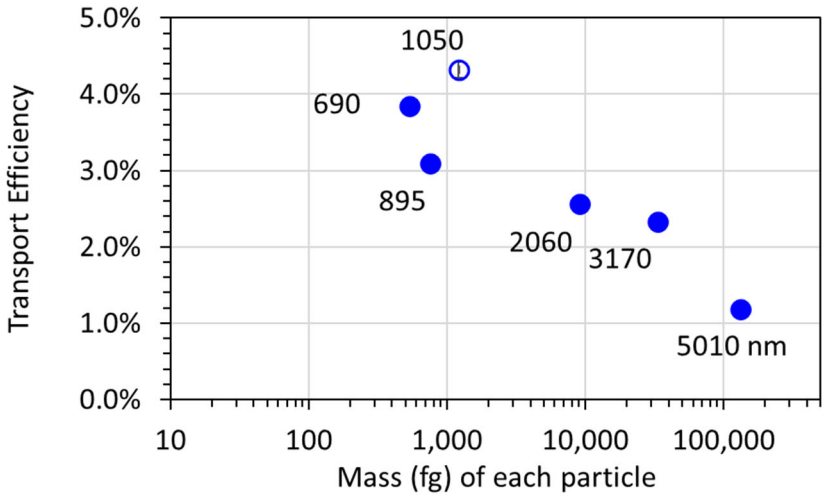

Fig. S2. Transport efficiency of engineered SiO_2 (●) microparticles as a function of the mass (fg) of each particle measured by spICP-QMS at using an uptake rate of 340 µL/min. The transport efficiency for 1050 nm SiO_2 (○) may be an outlier since it is unexpected larger than the transport efficiency for 690 or 895 nm SiO_2 particles. Error bars indicate +/- one standard deviation of three replicate measurements. The error bars are similar to or smaller than the size of the symbols used in the plot.

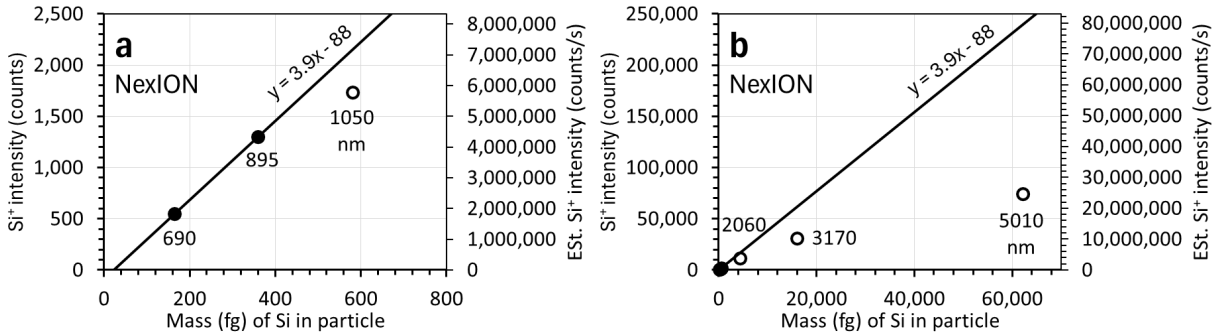

Fig. S3. $^{28}Si^{+}$ signal in counts (left y-axis) and estimated counts/s (right y-axis) as a function of Si mass in particle produced by engineered SiO_2 particles measured by spICP-QMS using optimized sensitivity for particles with: **(a)** masses less than 800 fg and **(b)** masses less than 62,000 fg. The nominal particle diameter is shown next to each point. Filled symbols indicate particles used to calculate the linear regression line while open symbols indicate particles not used to calculate the linear regression line.

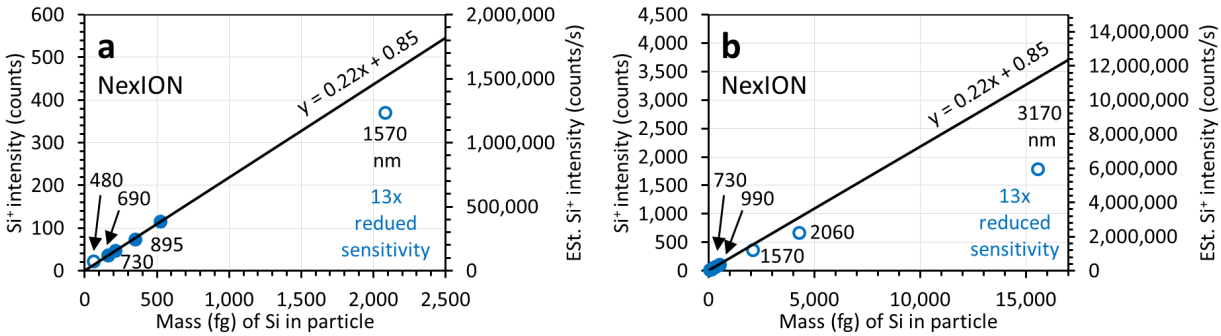

Fig S4. $^{28}Si^{+}$ signal in counts produced by engineered SiO_2 particles measured by spICP-QMS using 13x reduced sensitivity (Δm=0.5). The nominal particle diameter is shown next to each point. Filled points indicate particles used to calculate the linear regression line.

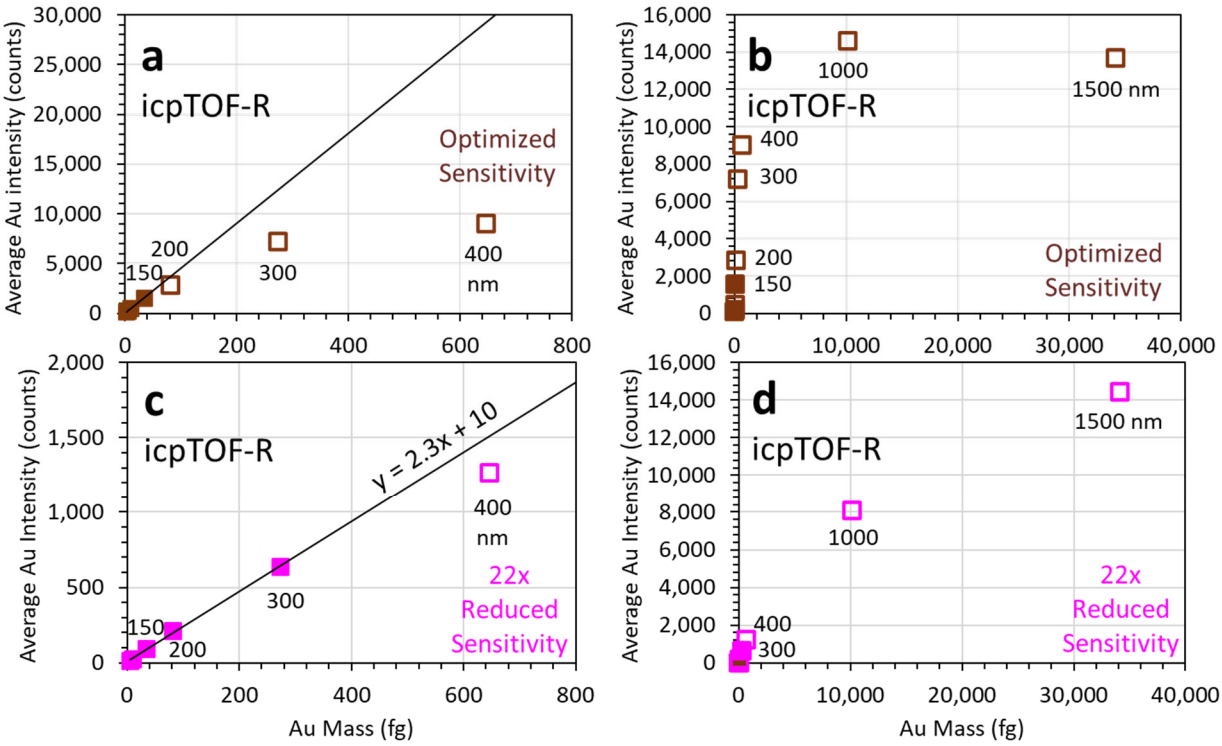

Fig. S5. Measurement of $^{197}Au^{+}$ signal intensities versus Au mass in particle produced by particles with diameters from 60 to 1500 nm with measured using TOFWERK icpTOF-R: **(a,b)** with optimized sensitivity and **(c,d)** 22x reduced sensitivities.