Supporting Information

Active Colloids Orbiting Giant Vesicles

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Video S1. In a 2% H_2O_2 aqueous solution, a silica-platinum Janus colloid, $R_P \approx 2$, µm self-propels towards a vesicle and is bound to an orbital trajectory around the GUV. The active particle approaches the vesicle and pushes it for the first seconds before advancing to an orbital motion. The black region corresponds to the platinum region of the particle.

Video S2. A silica-platinum Janus colloid, $R_P \approx 2$ µm, interacting with a giant lipid vesicle, $R_{GUV} \approx 9.4$ µm in a 2% H_2O_2 aqueous solution (video speed up 3 times). The active particle persistently rotates around the GUV, and eventually escapes the GUV orbit. The black region corresponds to the platinum region of the particle.

Video S3. Three dimensional rendering of the data of Video S2 created using a free open-source software POV-Ray. It consists of the exact particle trajectory, particle orientation and GUV location (speed up 3 times).

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Section S1. Shape variability in Janus boundary

Janus colloids partially coated with platinum are fabricated using a metal sputtering technique (Edwards Auto 306 Evaporator). Within this fabrication protocol, the platinum coating and the Janus boundary could exhibit a "wavy" or "bumpy" contour, see Figure S1. The roughness has a characteristic length scale of 20-40 nm in the platinum layer.

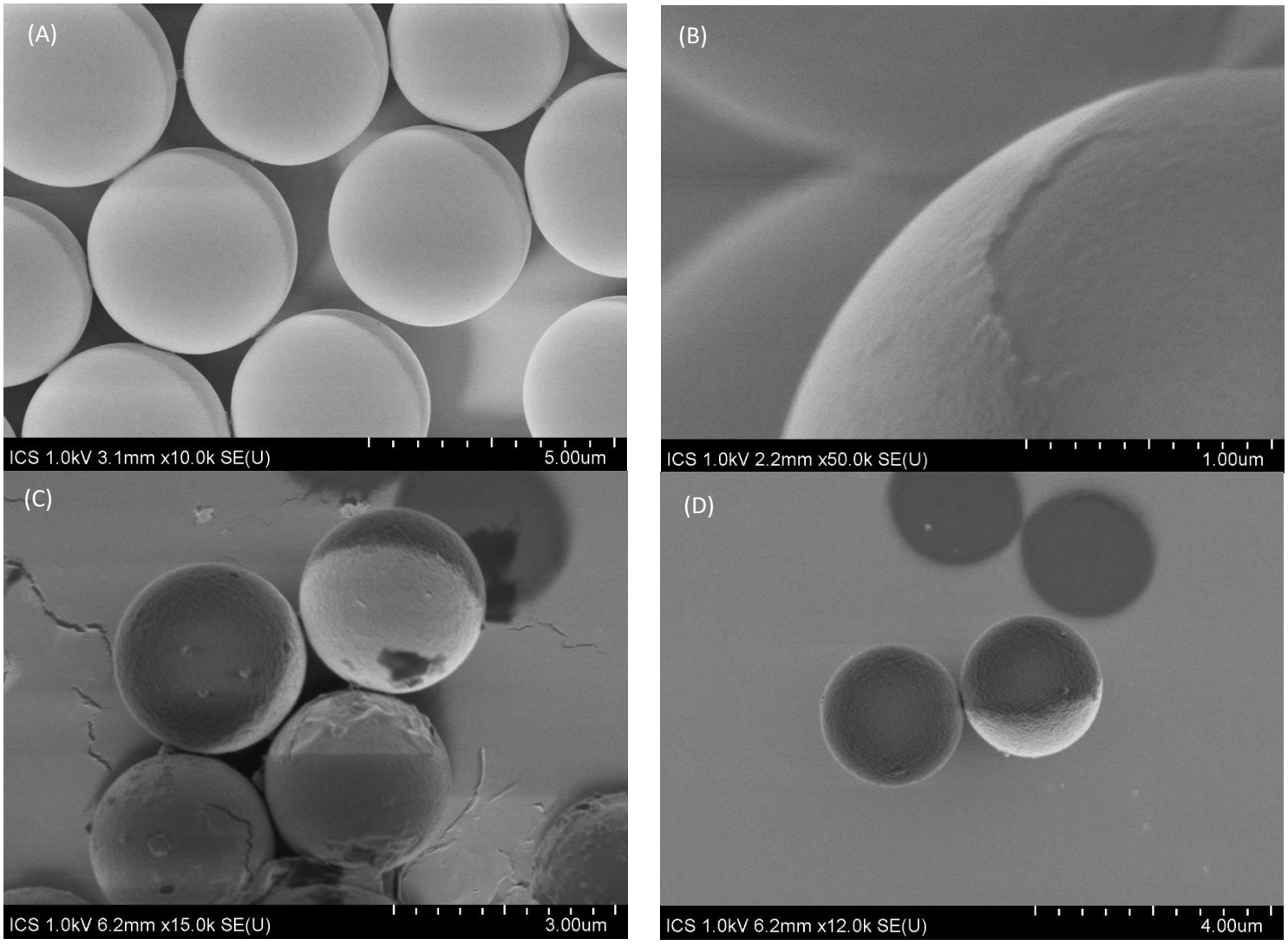

Figure S1. SEM images of $R_P \approx 2$ µm (A and B) and of $R_P \approx 1$ µm. (C) and (D) Janus colloids showing the sizes and the shapes of the platinum coating.

Section S2. Effect of Hydrogen Peroxide on GUV size distribution.

The effect of 2% hydrogen peroxide (H_2O_2) on the size distribution of GUVs is shown in Figure S2. The sample was prepared with 10 µL of GUV solution along with 130 µL of glucose filled in a silicon isolator adhered to a clear glass slide. Multiple images panning around the entire sample in both bright-field and fluorescent conditions were recorded. The same protocol is repeated before and after adding H_2O_2 to the sample for multiple trials. 2% concentration of the H_2O_2 alone did not appear to cause any significant changes to neither the density nor the size distribution of the GUVs in the sample. As seen from Figure S2, the average size for the vesicle remains around 11± 4 µm for long experimental times (up to 60 minutes).

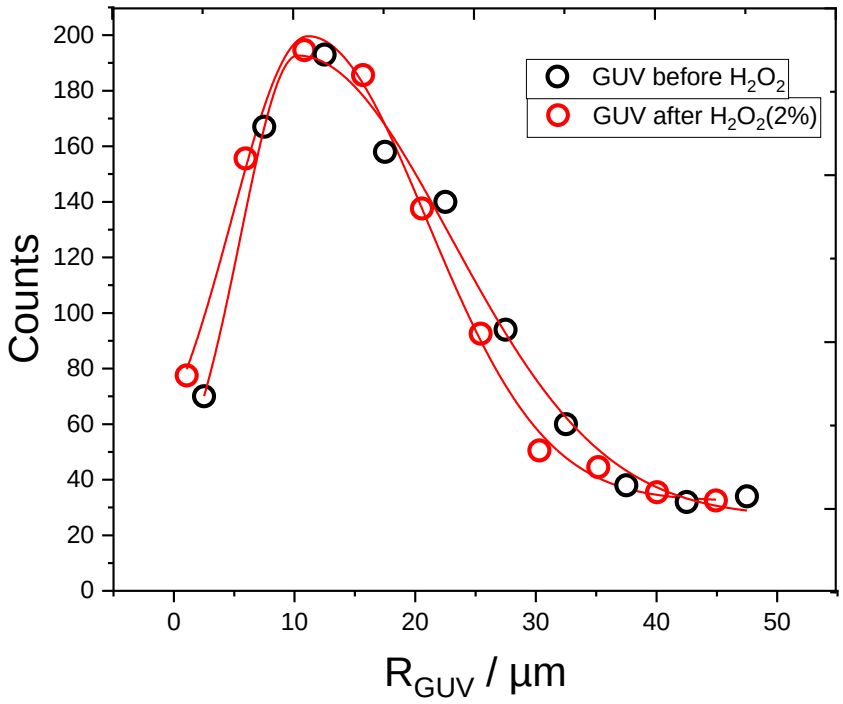

Figure S2. Size distributions of GUVs before and after the addition of hydrogen peroxide.

Figure S3 shows the orbital time as a function of the orbital radius (R_O) for all experiments where we could detect both the approach and escape time of an active particle interacting with an isolated vesicle. As already discussed in the main text, no critical orbital radius or vesicle radius was observed. Data shown in Figure S3 roughly follows the same statistics of the GUV size distribution shown in Figure S2.

Section S3. Orbital motion around vesicle

Figure S3 shows the orbital time as a function of the orbital radius (R_O) for all experiments where we could detect both the approach and escape time of an active particle interacting with an isolated vesicle. As already discussed in the main text, no critical orbital radius or vesicle radius was observed for the onset of the orbital motion. Data shown in Figure S3 roughly follows the same statistics of the GUV size distribution is shown in Figure S2.

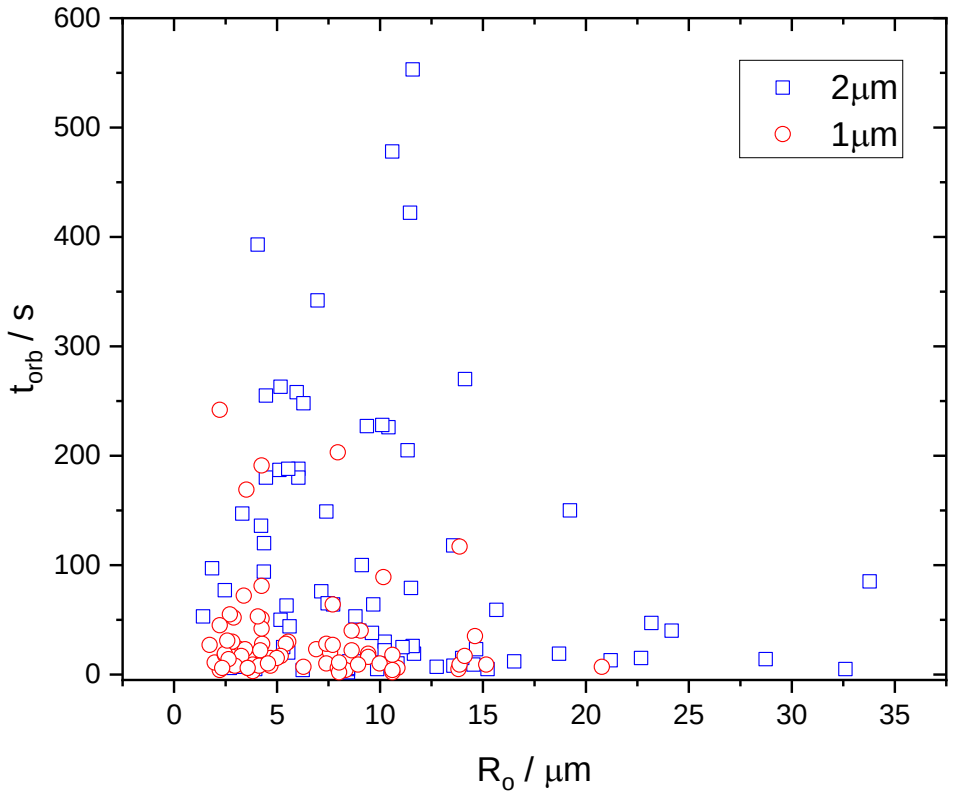

Figure S3. Orbital time versus orbital radius for $R_P \approx 1$ and 2 μm active colloids.