Supporting Information for

Photo-Activated Colloidal Dockers for Cargo Transportation

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Materials and Methods

***Particles synthesis*:** Peanut-shaped hematite (α- Fe_2O_3) particles were prepared by a gel-sol method as described by Sugimoto in [T. Sugimoto, M. Khan, A. Muramatsu, Colloid Surface A 1993, 70, 167]. In a typical synthesis 100 mL of $FeCl_3$ (2.0 M) was mixed with 90 mL of NaOH (6.0 M) and 5 mL of Na_2SO_4 (0.6 M) and aged in a preheated oven (100 °C) for 8 days. Finally, the particles were washed by repeated centrifugation and dispersed in deionized water. To improve the performance of the docker-particles we partially etched the hematite surface using hydrochloric acid (HCl) solutions (usually 5 M). This results in particles with a rougher surface [Fig. 1A] that respond significantly faster to the light than the smoother unetched particles.

Description of the movie material

Movie 1 shows the photo-activated cargo transportation. A peanut particle (length 1.5μm) is activated by the light and self-propels. After a few second, an external magnetic field is imposed , steering the particle and allowing the operator to approach and dock a 5μm-diameter polymer (TPM) colloid. The hematite particle phoretically docks the large colloidal cargo and allows to displace it. Changing the direction of the magnetic field allows to direct the cargo as visible here. Switching off the light, the hematite releases the cargo and diffuses away. Note the Brownian diffusion of the passive colloid in the top left corner. The movie is accelerated 2x.

Movie 2 shows an advanced manipulation of cargo colloids with a photo-activated hematite particle. A hematite particle (length 1.5μm) is used to pick and gather different cargo in the field of view showing the versatility of the phenomenon. The hematite peanut it directed towards a polymer (TPM) 5μm colloid which is docked, displaced and released. The same hematite particle is used to pick other colloids and so on, playing the role of a *colloidal shepherd*. The movie is accelerated 50x.

Movie 3 shows the displacement of a cargo on a textured substrate, following the nano- stripes of the PDMS substrate. Initially, the light is off. The texture on the substrate, visible on the light microscope, is very shallow and the hematite diffuses on top of the landscape without being trapped in the crenels. When the light is on, the hematite aligns with the texture of the substrate and phoretically attracts a neighboring polymer (TPM) 5μm colloid, and docks it. After formation of the cargo the particle self propels along the stripes of the substrate showing that the cargo follows the predetermined pathway designed on the surface. Note that this experiment is made in the absence of any external magnetic field and that here the direction of the propulsion is given by the direction of the stripes on the substrate. The movie is accelerated 2x.