Supplementary Information

we carried out a material toxicity experiment using Hela cells. An ordinary layer of hydrogel containing Hela cells, and another double layer (Janus layer) hydrogel containing Hela cells at the bottom and magnetic beads on the top layer were prepared as Fig.1 (this part is not included in the manuscript).

a) Glass slide was cut into pieces 10mm×10mm and sterilized.
b) Clean scotch tape was bonded to two edges to set up a barrier with thickness around 100 microns
c) 2% sodium alginate Hela cell suspension was poured on the slide.
d) After sweeping the excessive alginate away, $CaCl_2$ was added to induce the gelation.
e) Removing the scotch tape a layer of ordinary alginate hydrogel containing Hela cells was formed. And this ordinary layer was rinsed with great amount of culture medium to remove $CaCl_2$ solution.
f) To obtain Janus layer, intermediate product of (d) was bonded with another pair of scotch tape.
g-i) Similar operation was carried out to form a layer of alginate containing magnetic beads on the layer of hydrogel with Hela cells.

Then two group of hydrogel layer were put in Petri dishes with culture medium separately. The viability of cells was studied using FDA-PI labelling (Fig. 2). According to the result, the viability of Janus group was about 10% lower than ordinary group, but it can be seen that as time passing the trend of viability change was similar in the two groups. So we conclude the reagent and process did not produce obviously toxicity to embedded cells.

SEM image and Fe-mapping result was also given in Fig. 4, which accorded with magnified pictures and reconfirmed the spatial distribution of magnetic beads in Janus particle.

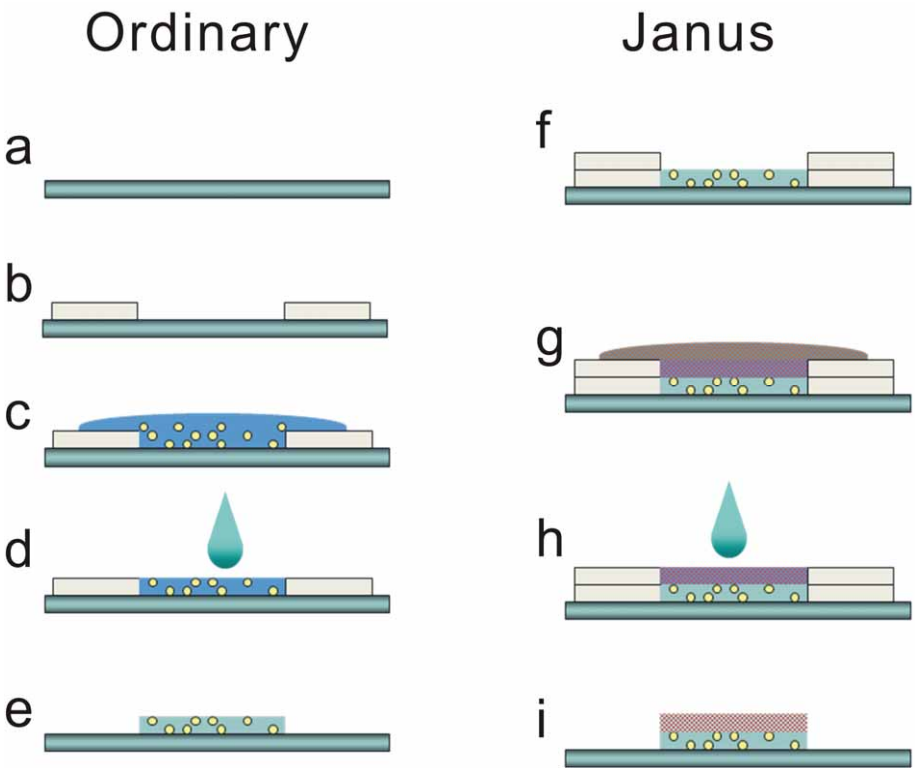

Fig. 1 Experiment process of cell viability

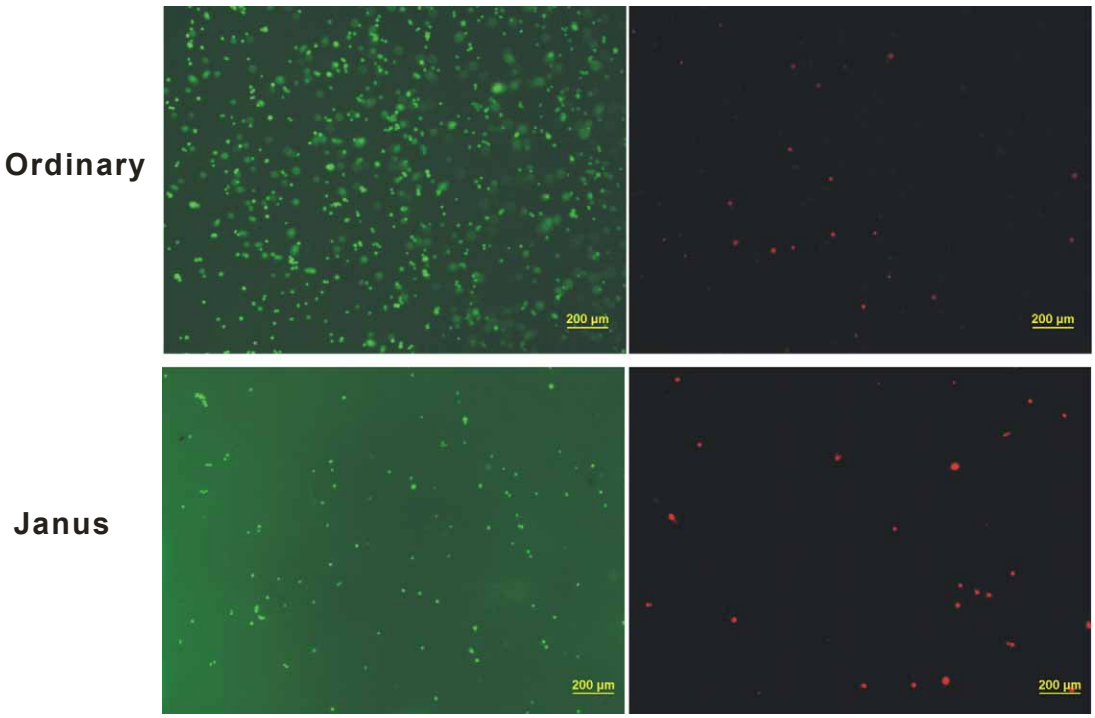

Fig. 2 Cell viability using FDA-PI.

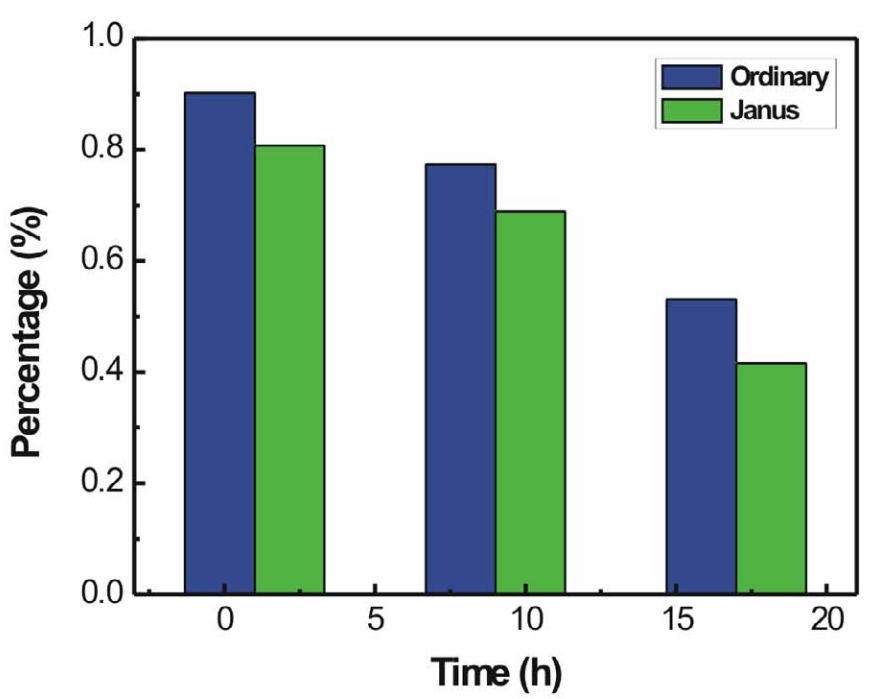

Fig. 3 Cell viability within 17 hour

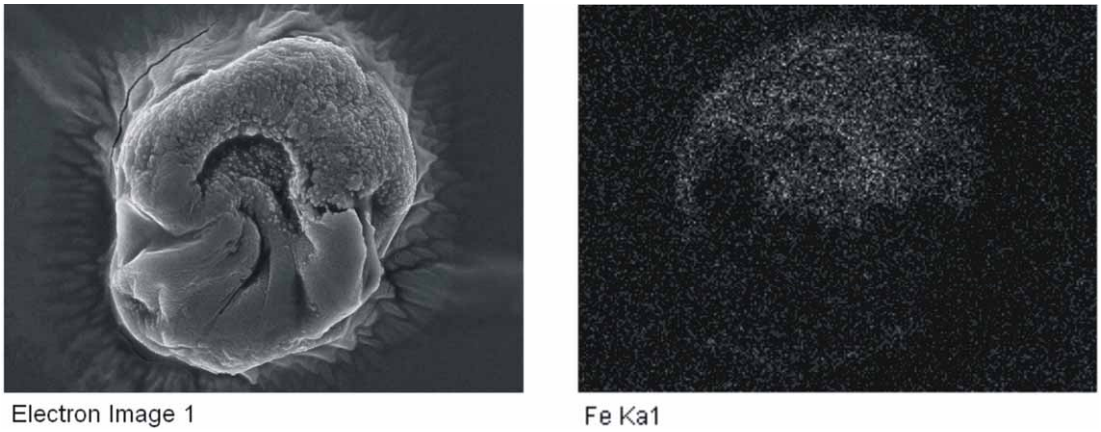

Fig. 4 SEM and Fe-mapping of a single Janus particle.