## Supplementary information

## **Image analysis**

We spatially filter all images to reduce high frequency noise, which mainly originates from small dust particles on the outside of the sample cell. We then define an area at near the end of the sample cell, indicated by the green area in Figure S1a, to use for image selection. We then select images based on the unique pattern of intensity values when crossing the two, black, walls of the cell. This is done to remove images in which only a part of the sample cell is imaged, due to minor mis-synchronisations between camera and centrifuge. The selected images are cropped to display only the sample cell; a reconstructed movie of the coalescence dynamics from these selected images can be found in the online supplementary information (movies S3 & S5, sped up 10x). We then apply the Matlab command "PixelList" to recognise all continuous areas of intensity in the images. This gives access to the area of each of these continuous spaces, as illustrated in Figure S1b; reconstructions of the recorded movies after this image processing step can also be found in the supplementary information, as movies S4&S6 (sped up 10x). The continous oil phase, used to track the amount of coalescence that has occured, shown as the big red area in Figure S1b, can then be automatically followed in time. In the same way, the sizes of individual droplets can be automatically followed.



S 1 Images analyze scheme.(a) is about algorithm (b) is result

From this data we can easily extract the evolution of the droplet size distributions in time; as shown in Figure S2. For front coalescence, the distributions do not change significantly (S2a), as droplets only coalesce with the large oil reservoir, which doesnt lead to disproportionation of the remaining droplets. By contrast, for bulk coalescence, the distributions of droplet sizes shifts to larger average sizes (Fig.S2b); as coalescence occurs everywhere also disproportionation occurs.



**S 2** The droplets distribution VS time at different coalescence modes. (a) is in front coalescence (b) is in bulk coalescence



 ${\bf S}$  7 The micro centrifuge results for emulsion stabilized with SDS 10mM.