

## 界面活性剤水相上を自走する 2 種の有機液滴の融合

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Fusion of two types of organic droplets self-propelled on the surfactant aqueous phase (<sup>1</sup>Graduate School of Integrated Sciences for Life, Hiroshima University, <sup>2</sup>Graduate School of Advanced Science and Engineering, Hiroshima University) ○Hiromi Hashishita,<sup>1</sup> Shinpei Tanaka,<sup>2</sup> Satoshi Nakata<sup>1</sup>

As an inanimate experimental system in which individual active matter forms a collective order, it has been reported that droplets consisting of salicylic acid ester and liquid paraffin form a characteristic pattern by self-driving on an aqueous solution of sodium dodecyl sulfate (SDS)<sup>1)</sup>. We investigated collective behaviors of two kinds of oil droplets placed on a surfactant aqueous solution.

Several self-propelled droplets of ethyl salicylate (ES) and butyl salicylate (BS) were placed on the surface of sodium dodecyl sulfate (SDS) solution, and the fusion between the droplets was observed. Fusion did not occur between the compositionally identical droplets but proceeded between the different droplets. As an initial condition, the total number of droplets is 40. When the total number of droplets was kept constant and the initial number ratio of ES droplets and BS droplets was changed, the probability of the fusion became maximum when the number of ES droplets was equal to that of BS droplets, i.e.,  $N_{ES}:N_{BS}=20:20$ .

Surfactant molecules are adsorbed on the surface of the droplet, and it is considered that fusion is less likely to occur due to electrostatic repulsion. The interfacial tension measurement,  $\gamma_{BS}=7.6\pm0.4$  mN/m and  $\gamma_{ES}=5.2\pm0.3$  mN/m. The results indicate that the difference in interfacial tension works as the driving force and fusion occurs.

**Keywords :** Droplets; Fusion; Surfactant; Self-propulsion

生物の集団運動のように、個々のアクティブマターが集団秩序を形成する無生物実験系として、サリチル酸エステルと流動パラフィンの混合液滴が界面活性剤であるドデシル硫酸ナトリウム(SDS)水溶液上で自己駆動することで特徴的な集団パターンを形成することが報告されている<sup>1)</sup>。サリチル酸エチル(ES)とサリチル酸ブチル(BS)の2種類の液滴を同時に複数個、SDS水溶液上で駆動させると、液滴どうしの融合が見いだされた。そこで本研究では、融合発現機構の解明を目的とした。

液滴は、周囲の表面張力差を駆動力として運動する。同種の液滴では融合が起こりにくく、異種の液滴どうしが融合した。ES液滴とBS液滴の総数は40滴とし、液滴の総数は一定にしてES液滴とBS液滴の個数比を変えると、個数比が1:1のときに最も融合が進行した。

液滴表面には界面活性剤分子が吸着しており、静電的反発によって融合が起きにくくなっていると考えられる。油滴と界面活性剤水溶液間における界面張力測定の結果、 $\gamma_{BS}=7.6\pm0.4$  mN/m、 $\gamma_{ES}=5.2\pm0.3$  mN/mであった。この界面張力差が駆動力となって融合が起こっていると考えられる。

1) Shinpei Tanaka, et al, J.Phys.Soc.Jpn, 2017, 86, 101004.

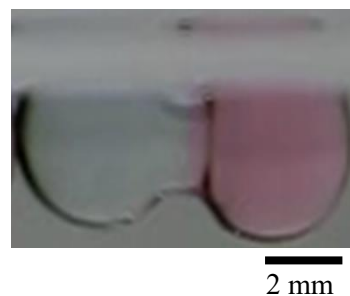


Fig.1 Fusion of droplets  
(Side view)  
Left:BS, Right:ES