

Study on yield behavior of colloidal gels with clay particles

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Colloidal gels are widely used as W/O emulsions. The important parameter of the W/O emulsions is the tactile impression in application to the skin. These parameters would be closely related to the yield behaviors. We found that some colloidal gel exhibits the yield behavior twice in a stress ramp test. The yield behaviors observed in low and high shear stress are named the first and second yield point, respectively. The aim of this study is to clarify the flow characteristic around the yield behaviors of the colloidal gels.

Fig.1 shows the Stress-Strain curve measured by a stress-ramp test. The Stress-Strain curve can be divided by four regions. The boundary of the region A and B is the first yield point and the second yield point appears between the region C and D. Fig.2 shows the results of the frequency sweep of dynamic viscoelastic test in each region. In all the regions except the region D, $\tan \delta$ exceeds 1 that indicates viscous property is dominant at low frequency. Although the curve of region D indicates elastic nature is dominant. Fig.3 shows photographs of the contour line of the sample in the parallel plate flow cell taken under the stress-ramp test. At first, the contour line of the sample shows circular shape, but it is suddenly distorted before the second yield point. After the second yield point, the contour line returns to a circular shape.

This transformation of the contour line should be caused by the hoop stress of the normal force effect and then the elasticity would be caused by the structure change related with the second yield point.

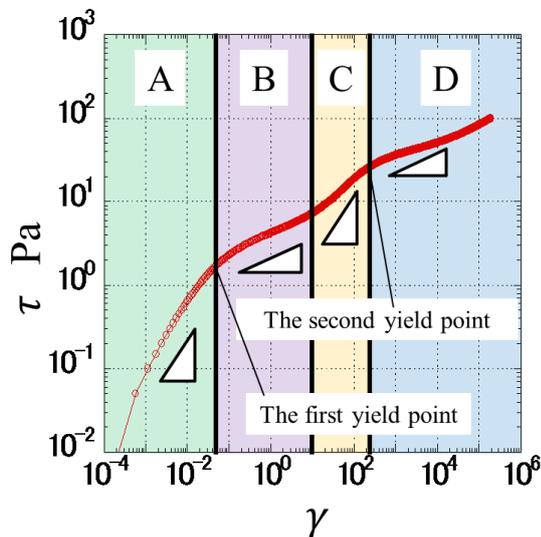


Fig.1. Stress-Strain curve observed by stress-ramp test. The curve can be separated into four regions by inflection points.

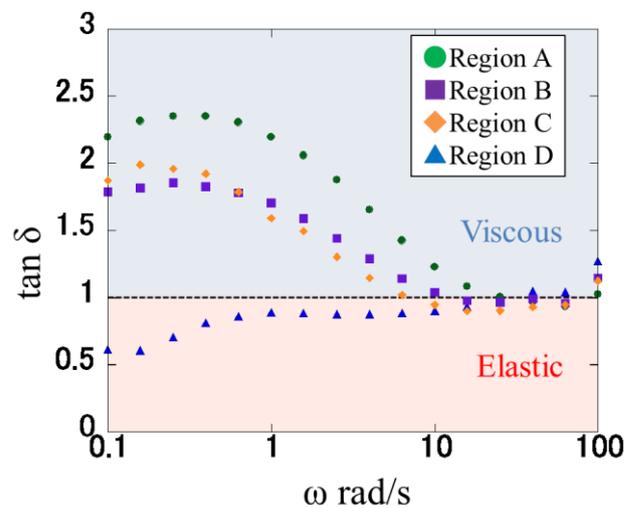


Fig.2. Results of the frequency sweep test for each region.

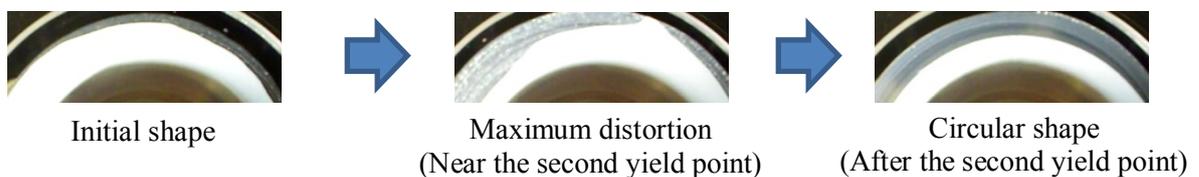


Fig.3. Transition of contour line of the samples while stress-ramp test.