Supporting information for:

Friction of polymer hydrogel studied by resonance shear measurements

Huai-Yin Ren,[a] Masashi Mizukami,[b] Tadao Tanabe,[b] Hidemitsu Furukawa,[c] Kazue Kurihara*[a,b]

[a]WPI-Advanced Institute for Materials Research, Tohoku University, 2-1-1 Katahira, Aoba-ku, Sendai 980-8577, Japan, [b]Institute of Multidisciplinary Research for Advanced Material, Tohoku University, 2-1-1Katahira, Aoba-ku, Sendai 980-8577, Japan and [c]Graduate School of Science and Engineering, Yamagata University, 4-3-16 Jonan, Yonezawa 992-8510, Japan.

Correspondence and requests for materials should be addressed to K.K. (email: kurihara@tagen.tohoku.ac.jp; Tel: 022-217-6253; Fax: 022-217-6154.)

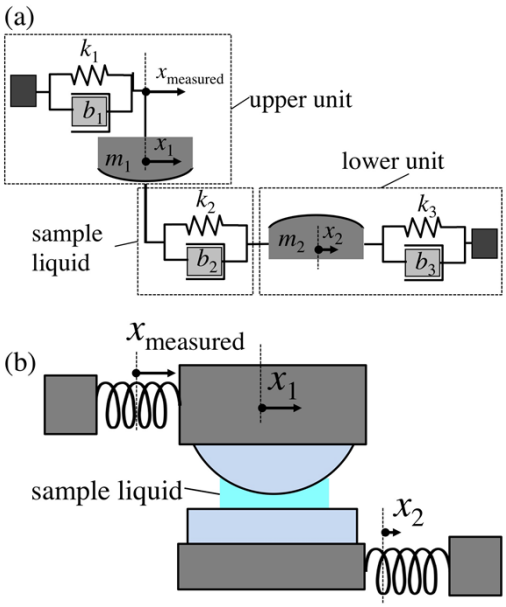

Fig. S1 (a) Physical model and (b) schematic drawings of the shearing system for the studies of confined liquids

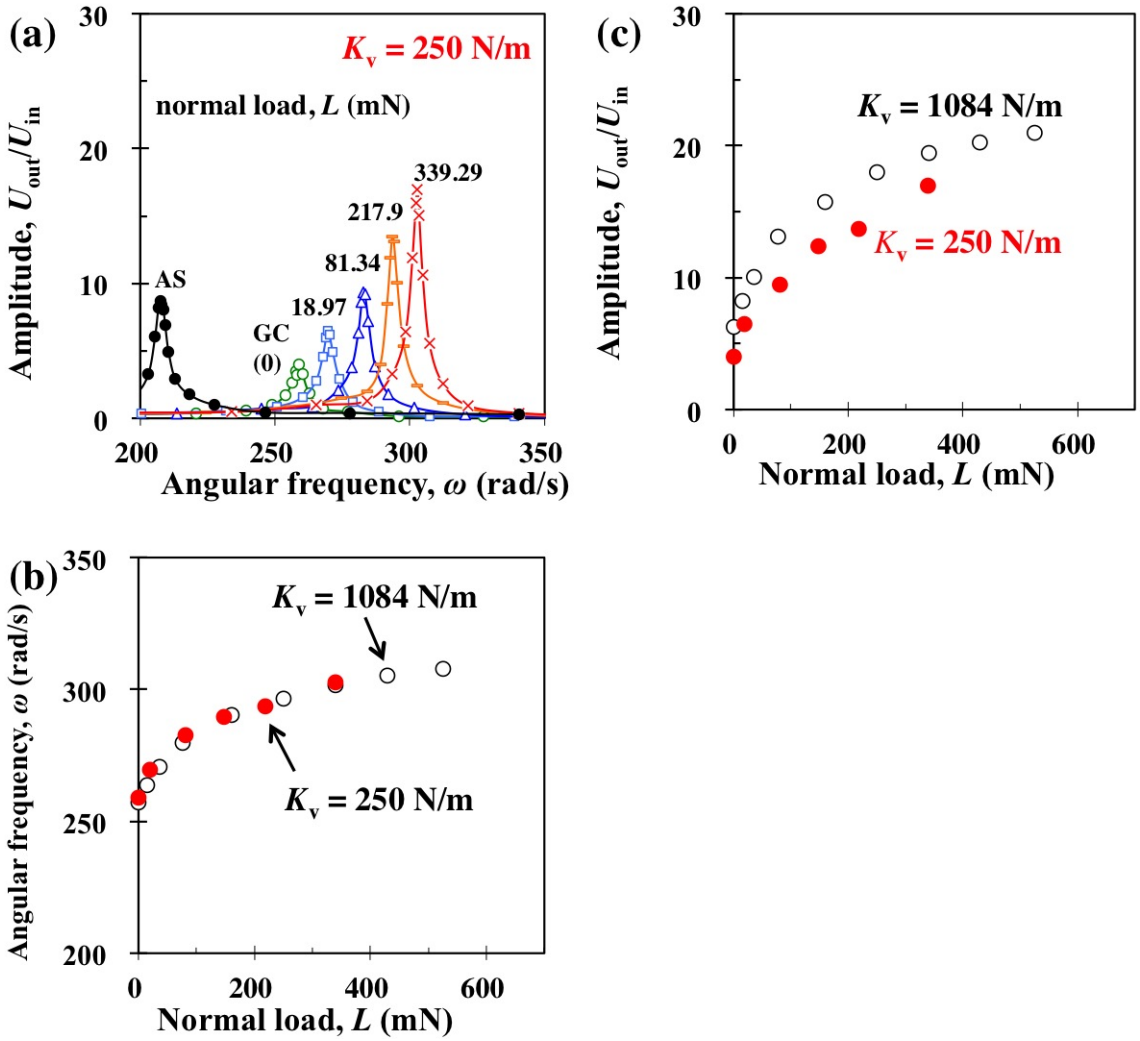

Fig. S2 (a) Resonance curves for the silica sphere/gel interfaces surfaces using a pair of soft leaf springs (K_v= 250 N/m) and summarized changes in (b) angular frequencies and (c) amplitudes as a function of the normal load between resonance curves when using different stiff springs.

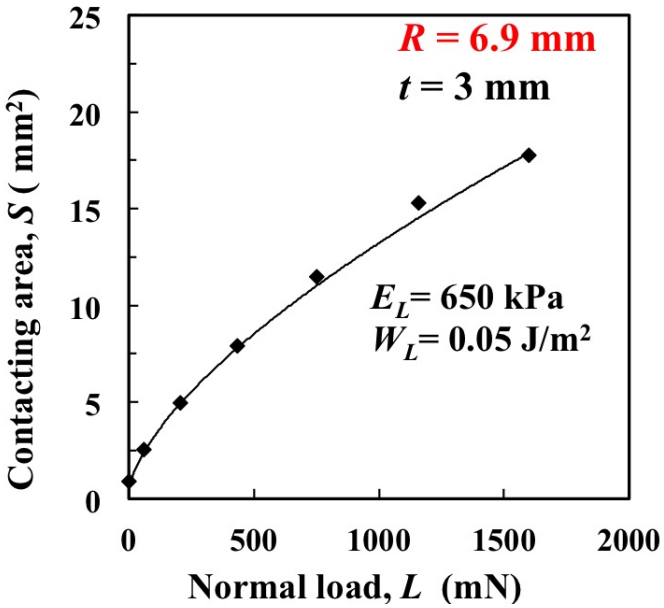

Fig. S3 Contacting area–normal load (S vs. L) curves for the silica sphere (R = 6.9 mm) on the flat DN gel (t = 3 mm) during the loading process. R = 6.9 mm, t = 3 mm; the gel surface was exposed to dry air in the closed RSM chamber. The symbols and the solid lines were the experimental data and fitting curves, respectively.

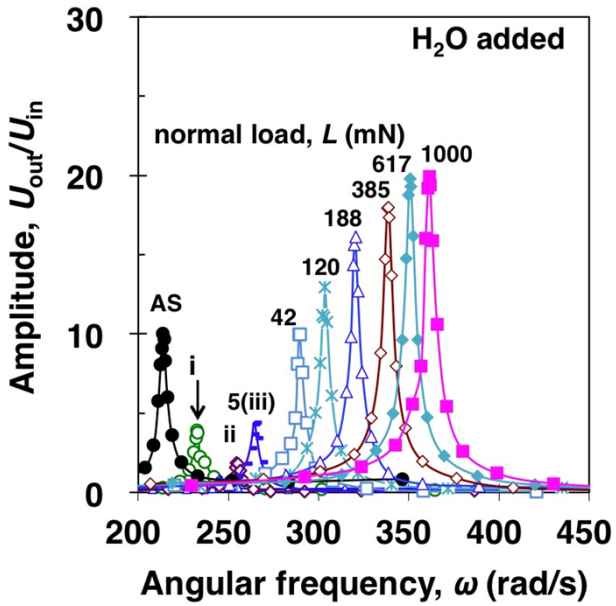

Fig. S4 Changes in the resonance shear curves as a function of the normal load for the silica sphere/gel interfaces with the addition of water between the two surfaces. The silica sphere with R = 6.9 mm was used. Leaf springs of K_v =1084 N/m were used as the lower horizontal springs. The estimation of S and L using the ω vs. S and S vs. L relations (Fig.S5c and Fig. S5d) did not apply to curves (i) and (ii) due to the presence of water preventing the full contact of the gel and silica sphere unlike the case without the addition of water. The gel sample was moved upward by 10 μm, 115 μm by the pulse motor from curve-(i) to (ii) and (ii) to (iii), respectively.

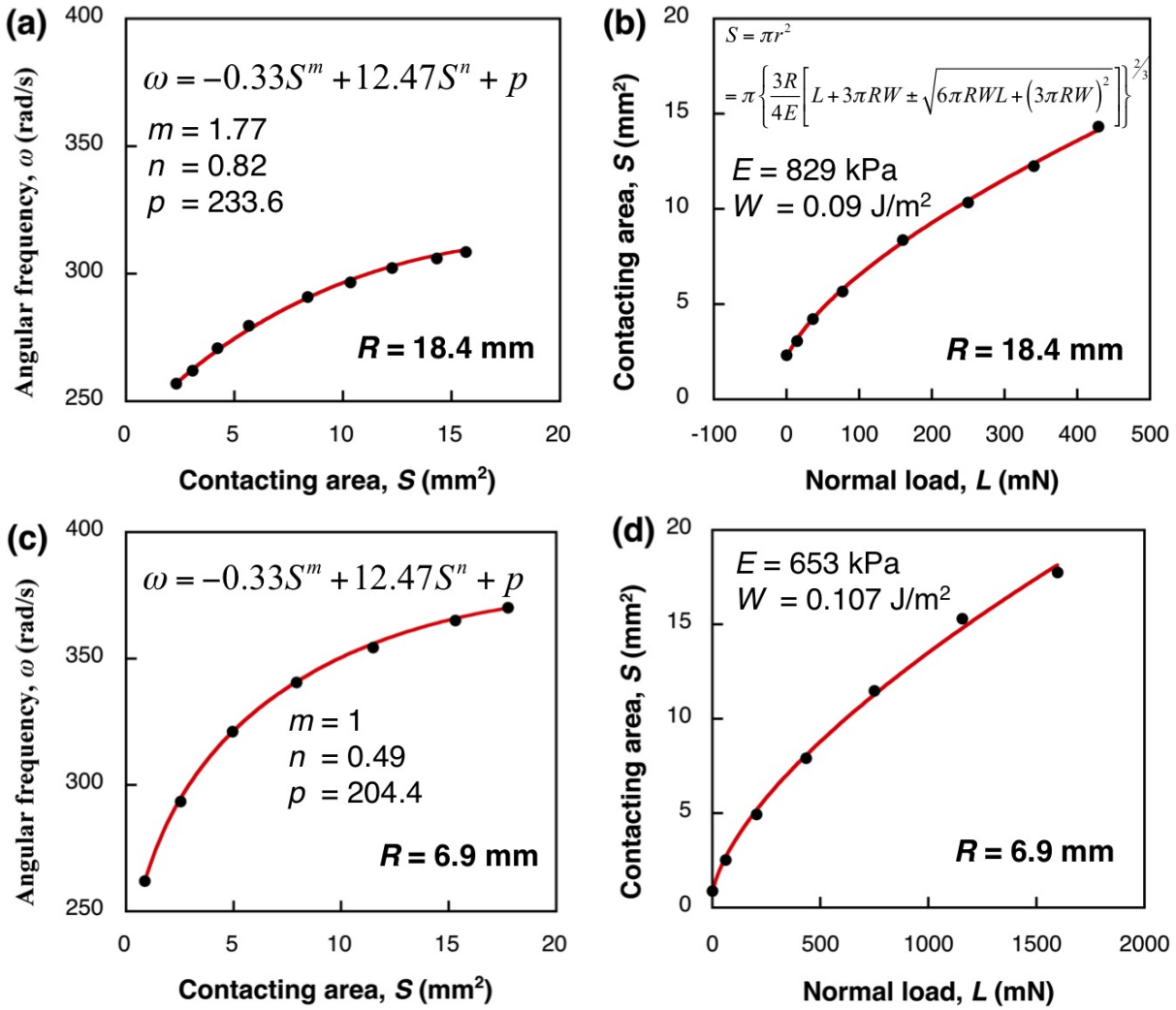

Fig. S5 Estimation of the contacting area (S) and normal load (L) for resonance curves with the addition of water. (a) plot of ω vs. S and (b) plot of S vs. L (R = 18.4 mm); (c) plot of ω vs. S and (d) plot of S vs. L (R = 6.9 mm)

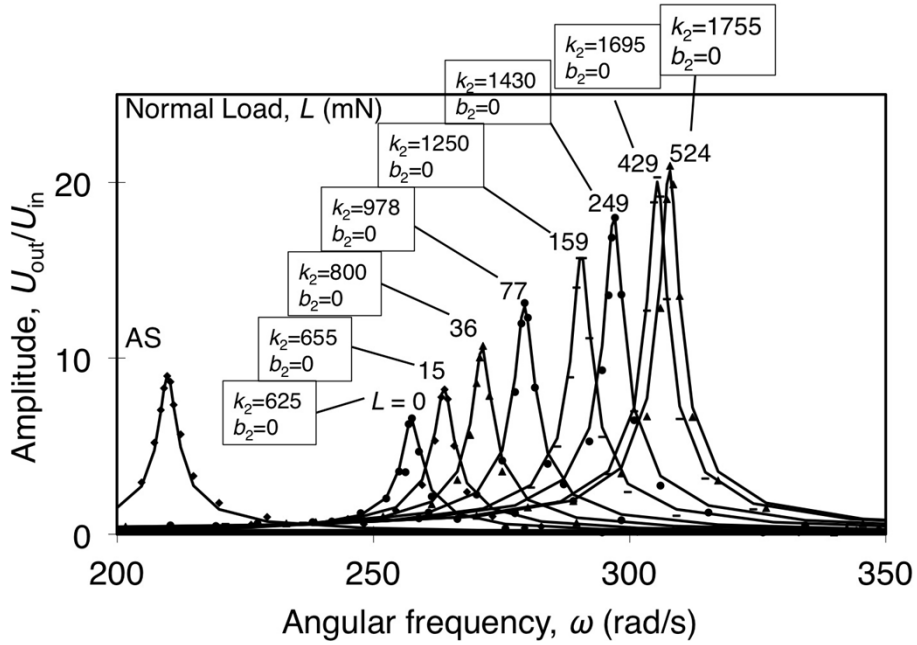

Fig. S6 Resonance curves for the silica sphere/gel interfaces for various normal loads without the addition of water between the two surfaces. The silica sphere with R = 18.4 mm was used. The solid symbol was the experimental data. The line was the theoretical fitting curve using eqn (4).

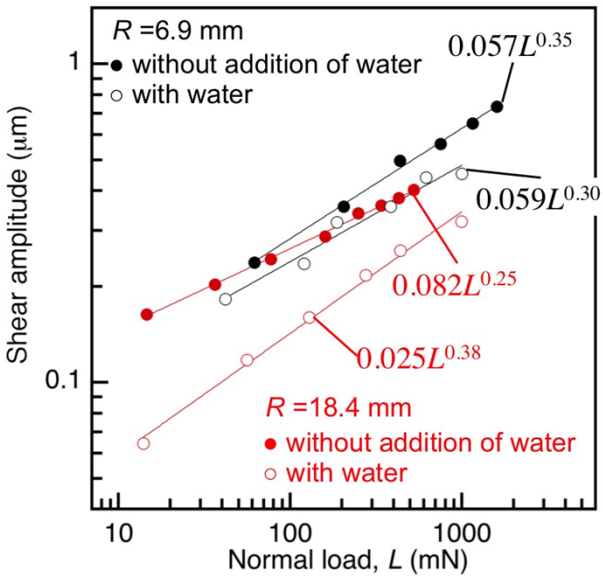

Fig. S7 Plot of shear amplitude vs. L.