

# Supporting Information for “Slide-hold-slide experiments and frictional healing in a simulated granular fault gouge”

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## Contents of this file

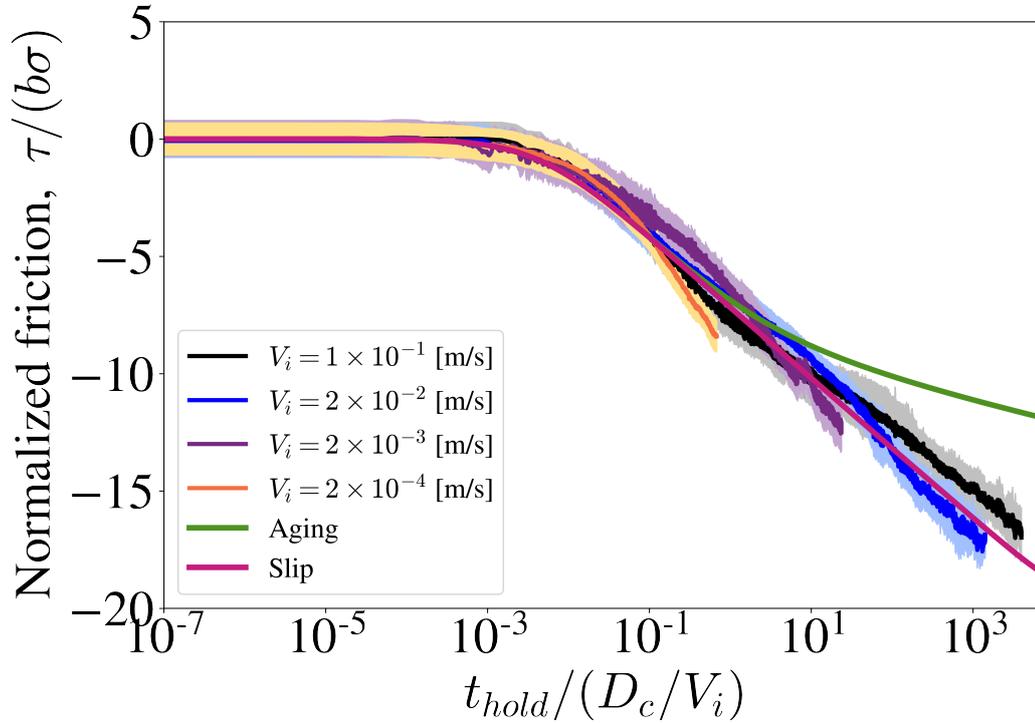
1. Table S1
2. Figure S1
3. Figure S2

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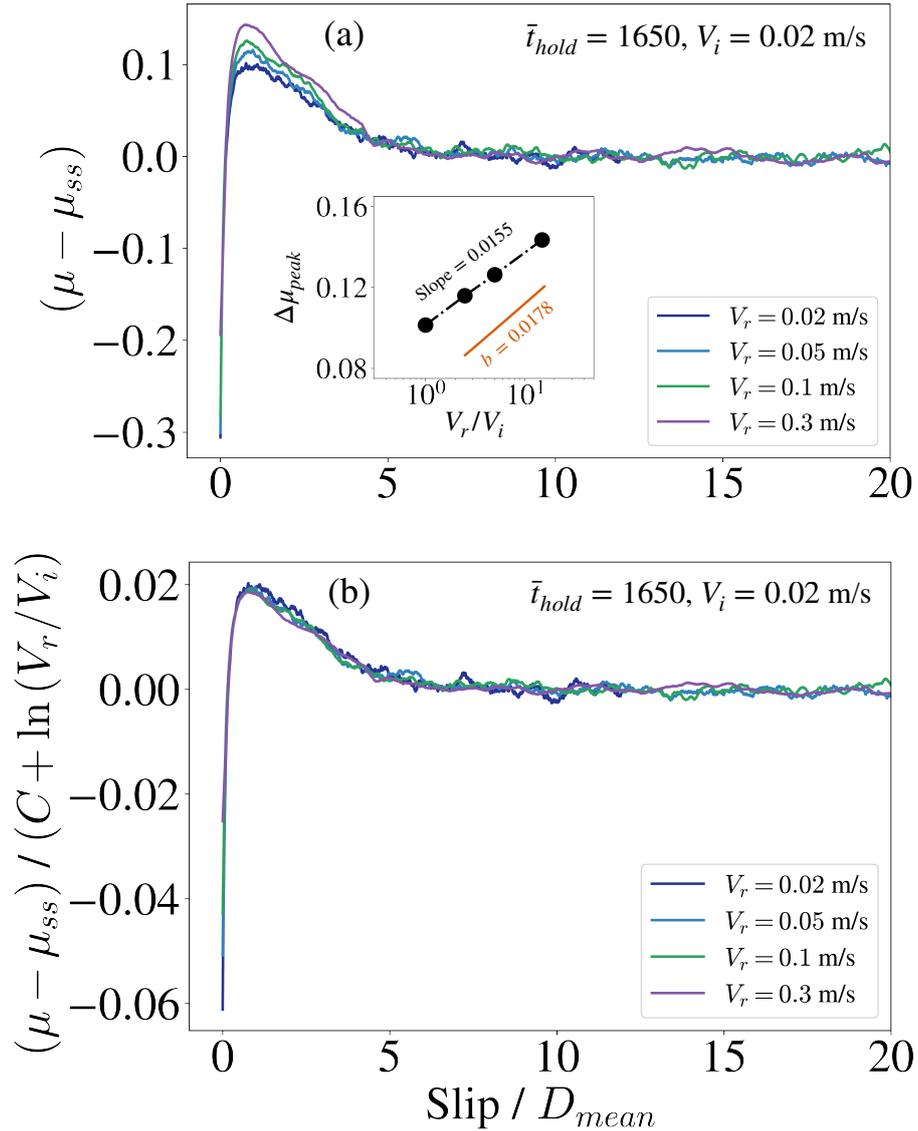
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Table S1. DEM simulation parameters. If in some limited simulations, different parameter values are used, they are explicitly mentioned in the text.

| Parameter                                 | Value                     |
|---|---------------------------|
| Grain density, $\rho$                     | 2500 [kg/m <sup>3</sup> ] |
| Young's modulus, $E$                      | 50 [GPa]                  |
| Poisson ratio, $\nu$                      | 0.3                       |
| Grain-grain friction coefficient, $\mu_g$ | 0.5                       |
| Confining pressure, $\sigma_n$            | 5                         |
| Coefficient of restitution, $\epsilon_n$  | 0.98                      |
| Time step, $\Delta t$                     | $2 \times 10^{-8}$ [s]    |



**Figure S1.** The variation of friction coefficient in slide-hold simulations with prior sliding velocities  $V_i$  of  $2 \times 10^{-4}$ ,  $2 \times 10^{-3}$ ,  $2 \times 10^{-2}$ , and  $10^{-1}$  m/s. All simulations are run with system stiffness  $\bar{k}_d \approx 425$  at the confining stress 5 MPa. The lines show the mean behavior of 8 realizations for each system, and the width of the shades regions around each line shows the 2-sigma deviations. The pink and green lines in panels (a) & (b) further show the predictions of the Slip and Aging laws, respectively, using the RSF parameters ( $D_c = 0.0053$  m,  $a = 0.0247$ ,  $b = 0.0178$ ) determined independently from Slip-law fits to velocity-step tests performed on the same model (Ferdowsi and Rubin, 2020).



**Figure S2.** The variation of (a) friction  $(\mu - \mu_{ss})$  versus slip distance ( $Slip / D_c$ ), and (b) normalized friction  $(\mu - \mu_{ss}) / (C + \ln(V_r/V_i))$  versus slip distance ( $Slip / D_c$ ), during reslide portion of slide-hold-slide simulations for normalized hold time  $\bar{t}_{hold} \approx 1650$ , with the initial sliding velocity,  $V_i = 0.02$  m/s, and different reslide velocities,  $V_r = 0.05$  m/s, 0.1, and 0.3 m/s. The value of  $C \sim 5$  is chosen empirically. The inset in panel (a) shows the variation of peak friction  $(\mu - \mu_{ss})_{peak}$  versus the ratio of reslide to initial velocity,  $V_r/V_i$ . All simulations are run with system stiffness  $\bar{k}_d \approx 425$  at the confining stress 5 MPa.