*Table 1 Material properties and scaling parameters.*

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| --- | --- | --- | --- |
| Material properties and scaling parameters | Model | Nature | M/N ratio |
| Grain shape |  |  |  |
| - quartz sand | angular | ­— | — |
| - microbeads | well rounded | — | — |
| Grain size |  |  |  |
| - quartz sand | < 0.2 mm | — | — |
| - microbeads | < 0.2 mm | — | — |
| Length | 0.05 m | 1000 m | *l­­*\* = 5×10-6 |
| Density |  |  |  |
| - quartz sand | ~1300 kg/m3 (a) | 2400-2800 kg/m3 (b) | *ρ\* ≈* 0.5 |
| - microbeads | ~1400 kg/m3 (c) | 2400-2800 kg/m3 (b) | *ρ\* ≈* 0.5 |
| Gravity | 9.8 m/s2 | 9.8 m/s2 | *g\** = 1 |
| Stress (cohesion) |  |  |  |
| - quartz sand | 100-150 Pa (b) (d) | 40-60 MPa | *σ\** = *ρ\* g\* l­­*\* = 2.5×10-6 |
| - microbeads | 30 Pa (b) (e) | 12 MPa | *σ\** = *ρ\* g\* l­­*\* = 2.5×10-6 |

(a) Wang et al. (2016); (b) Gomes (2013); (c) Panien et al. (2006); (d) Eisenstadt and Sims (2005); (e) Krantz (1991).