Table 1. Physical properties of target materials used in the experiments.

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| **Target material** | **Grain size**  **[μm]** | **Friction angle**  **[ ̊ ]** | **Density (δ)**  **[g cm-3]** | **Porosity**  **[%]** |
| Beach sand (EPIC)  85% quartz  15% feldspar | 2000-1000: 0.18%  1000-500: 56.94%  500-250: 38.0%  250-125: 4.53%  <125: 0.24% | 34.6 ± 0.8 (slow pour)  30.4 ± 1.7 (fast pour) | 1.795 (max)  1.576 (min) | 32  40 |
| Iron grit sand (EPIC) | 2000-1000: 42.6%  1000-500: 56.6%  500-250: 0.76%  250-125: 0.04% | 41.0 ± 1.4 (slow pour)  32.0 ± 0.8 (fast pour) | 4.440 (max)  3.627 (min) | 44  54 |
| Quartz sand (Boeing)  “Lane Mountain 20-30”  99.6% SiO2 | <1180: 100%  850-1180: 2.5%  600-850: 27%  425-600: 55%  300-425: 12.5%  <300: 3% | 39° | 1.498 (max) | 44 |
| Chromite sand (Boeing) | Not measured | Not measured | 3.81 (max) | 20 |