Supporting information

$CaZnOS:Nd^{3+}$ emits tissue-penetrating near-infrared light upon force loading

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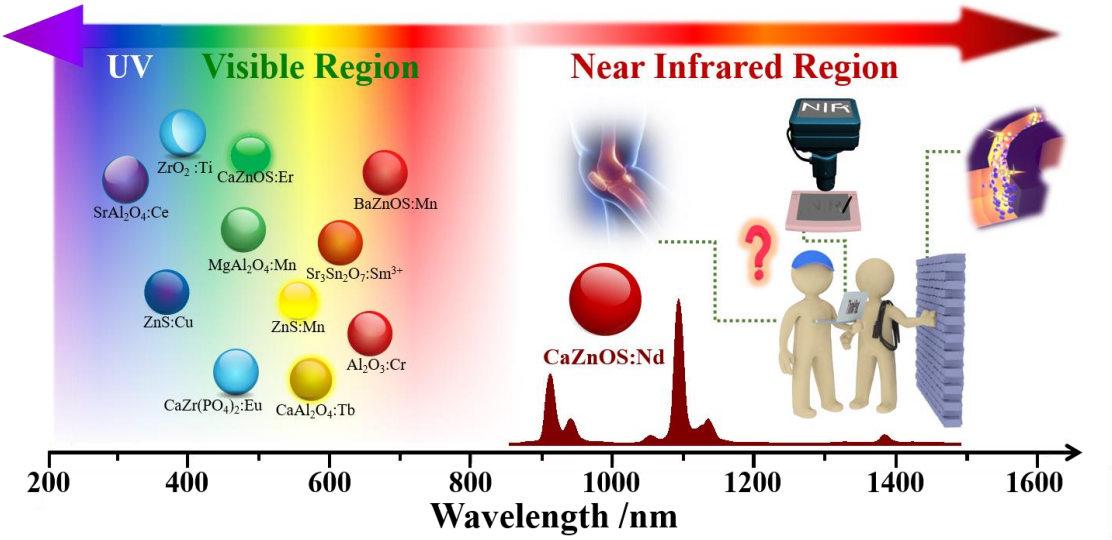

Figure S1. Overview of existing ML materials with luminescence within near ultraviolet to visible region. However, for biological imaging, such as imaging biomechanical changes of tissues and encryption of digital signature, and health monitoring, NIR ML materials are needed but remain unexplored. In the upper right corner, a pencil is schematically placed on a sheet made of NIR ML material and the glowing trace is recorded by a NIR camera above the sheet to highlight what letters are written on the sheet.

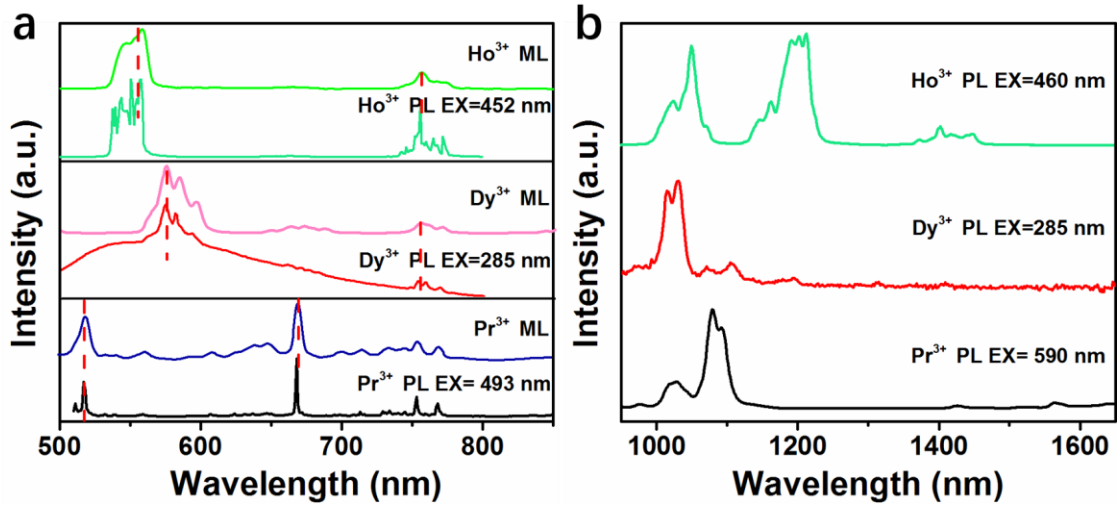

Figure S2. (a) The photoluminescence (PL) and ML of CaZnOS:RE^{3+} (RE^{3+}=Ho^{3+}, Pr^{3+}, Dy^{3+}), which is in accordance with in the range of 450 ~ 900 nm. (b) The NIR ML emissions of CaZnOS:RE^{3+} (RE^{3+}=Ho^{3+}, Pr^{3+}, Dy^{3+}) are not observed even if NIR emissions can be activated by a short wavelength light.

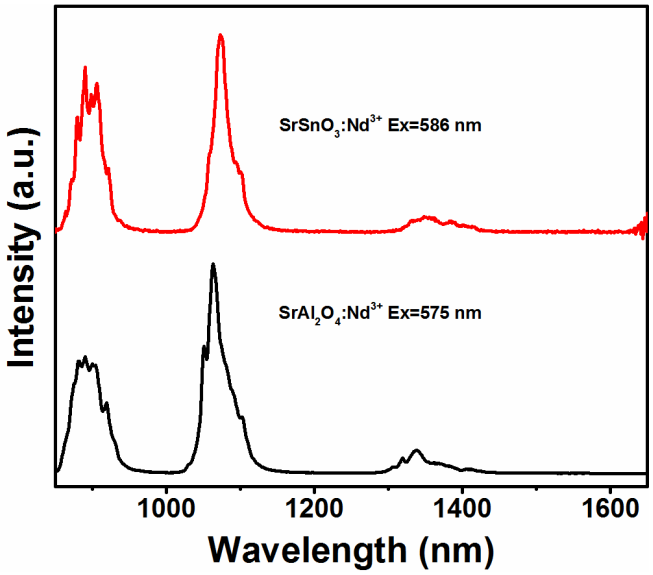

Figure S3. The NIR PL spectra of $SrAl_2O_4:Nd^{3+}$ and $SrSnO_3:Nd^{3+}$.

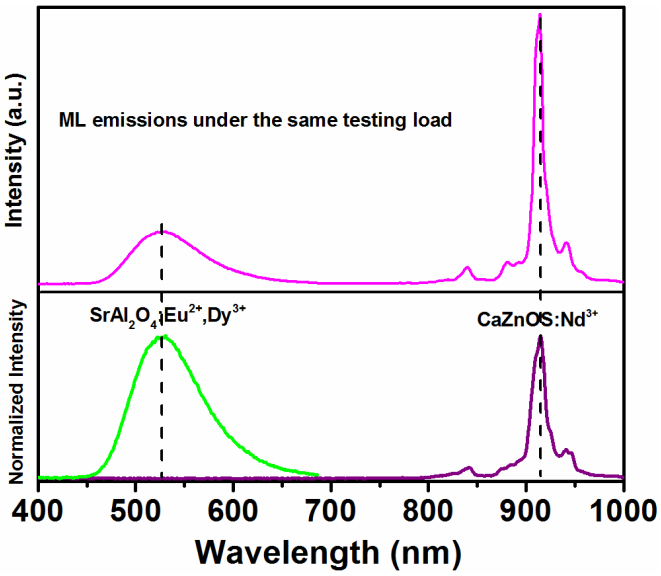

Figure S4. Top: ML intensity of a mixtuture consisting of as-prepared $CaZnOS:Nd^{3+}$ and the currently reported most efficient visible ML phosphor $SrAl_2O_4:Eu^{2+}$, Dy^{3+} under a load of 3000 N. The NIR ML intensity is five times greater than that visible ML from $SrAl_2O_4:Eu^{2+}$, Dy^{3+}. **Bottom**: The normalized ML intensity of as-prepared $CaZnOS:Nd^{3+}$ alone (purple curve) and the currently reported most efficient visible ML phosphor $SrAl_2O_4:Eu,^{2+}Dy^{3+}$alone (green curve).

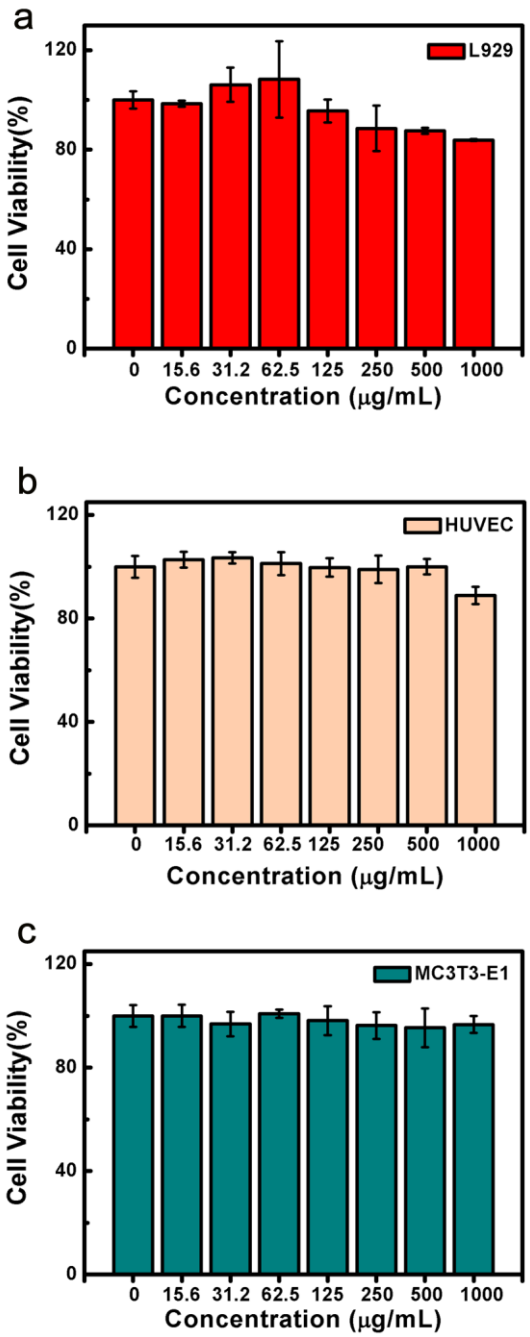

Figure S5. The *In vitro* cytotoxicity of different concentrations of CaZnOS:1.0%Nd^{3+} particles on (a) L929, (b) HUVEC and (c) MC3T3-E1 cells after co-cultured for 24 h at 37 ^{o}C incubation.