Supplementary materials

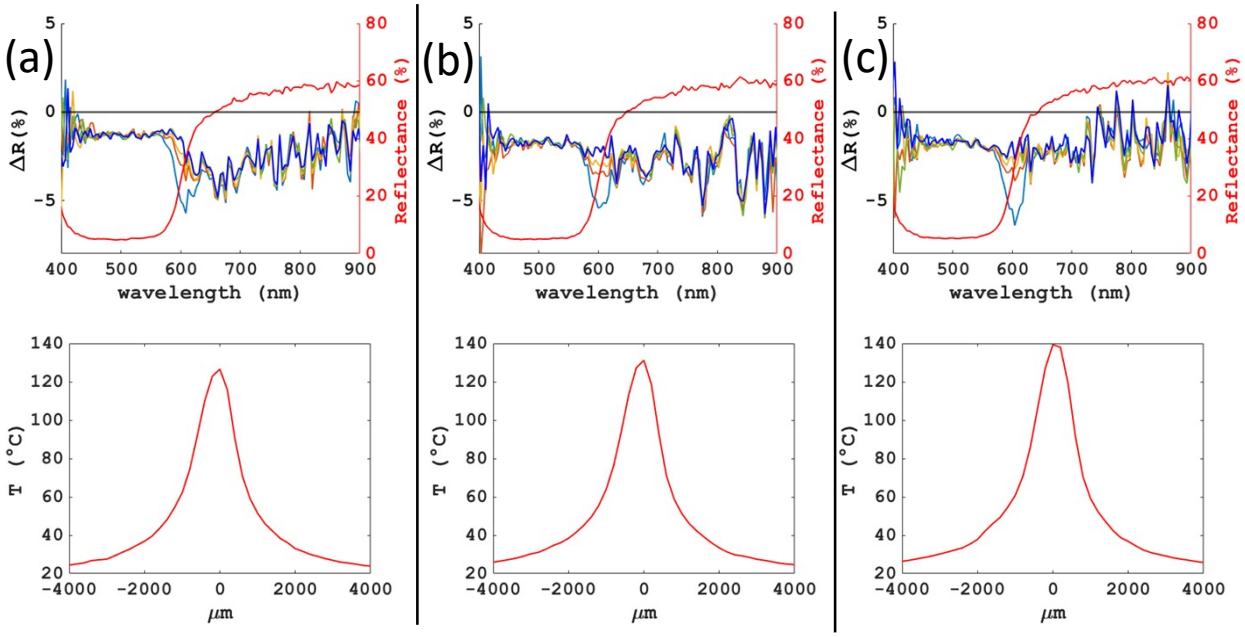

Fig. S1. Reproducibility test: vermilion paint mock-up irradiated with high power at 100 mW for 10 s with a spot size of 900 µm repeated 3 times (a, b, c) to check the reproducibility. Top row: ΔR VIS-NIR changes (1 s light blue, 5 s orange, 10 s yellow, 60 s green, 300 s dark blue post irradiation, in red the reference spectrum before irradiation). Bottom row: temperature profile around the laser spot.

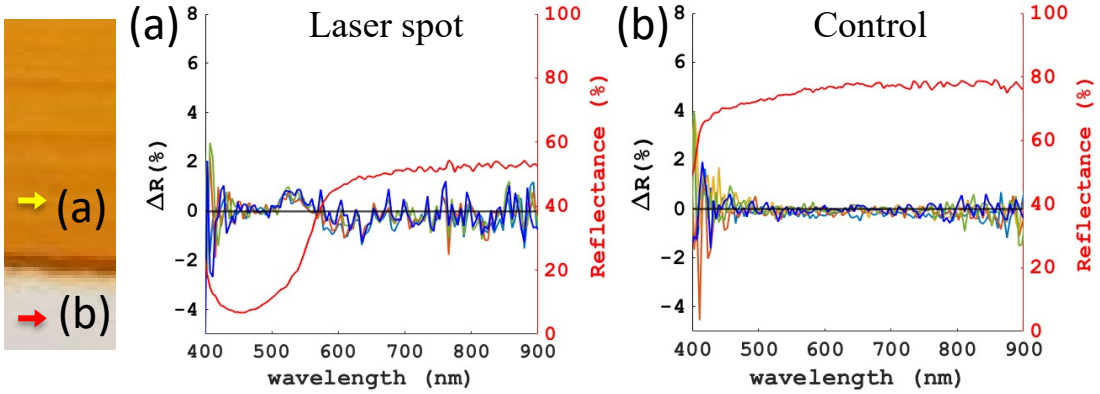

Fig. S2. Internal control for quality check of the data: the ΔR VIS-NIR changes (1 s light blue, 5 s orange, 10 s yellow, 60 s green, 300 s dark blue post irradiation, in red the reference spectrum before irradiation) of (a) realgar irradiated at 2.8 mW for 10 s with a spot size of 900 µm and in (b) the internal control using the white substrate away from the laser spot but still along the slit of the hyperspectral imaging system.

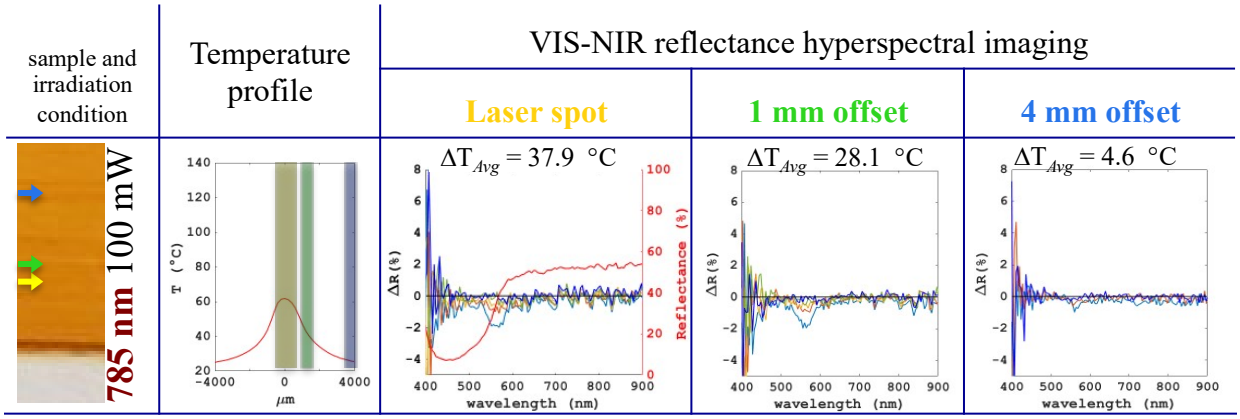

Fig. S3. The thermal effect of 785 nm on realgar mock-up irradiated with 785 nm laser with a spot size of 900 μm at 100 mW for 10 s. Column 1: images of the irradiated areas (the yellow arrow indicates the position of the laser spot, green arrow is 1mm offset and blue arrow is 4mm offset from the laser spot); Column 2: temperature profile just before turning off the laser (yellow, green and blue bands indicate the position centered at the laser spot, 1 mm and 4 mm offset from the laser spot); Column 3: ΔR difference reflectance spectra (1 s light blue, 5 s orange, 10 s yellow, 60 s green, 300 s dark blue) at the position of the laser irradiation, and the reflectance spectrum of the mock-up prior to irradiation (red curve). Column 4: evolution of ΔR spectra 1 mm away from the centre of the laser spot; Column 5: 4 mm away from the laser spot. The average temperature change (ΔT_{Avg}) is indicated in each case.

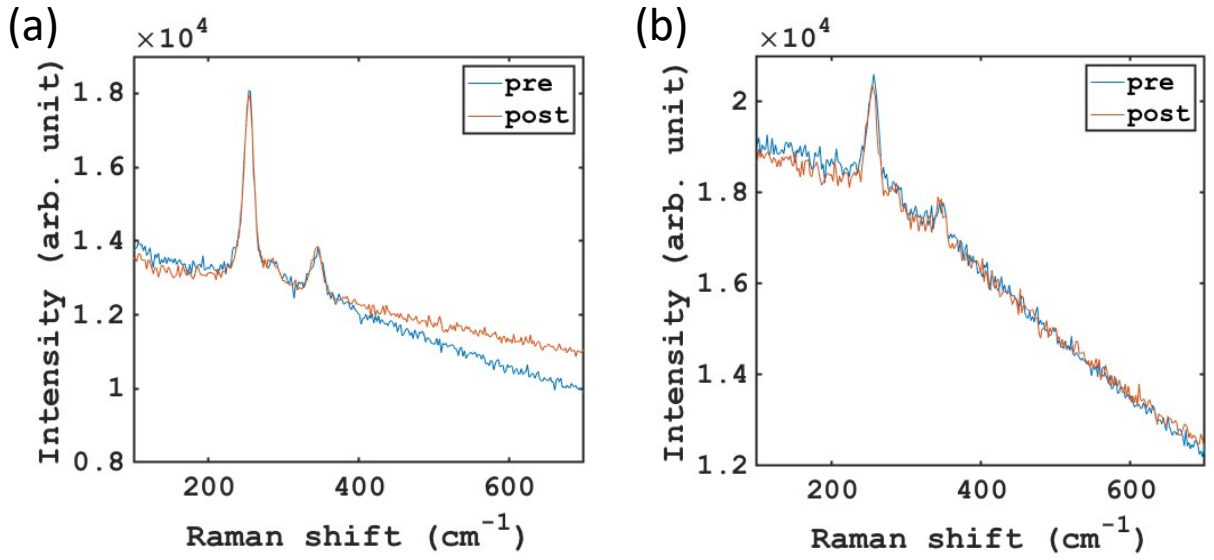

Fig. S4. Raman spectra collected with 785 nm laser for the irradiations test a) during the 785 nm irradiation with 900 μm spot, 100 mW for 10s; and b) before and after irradiation with 532 nm laser at 100 mW, 10 s with a 900 μm spot size. The background was shifted vertically to better visualize the differences in the Raman peaks.

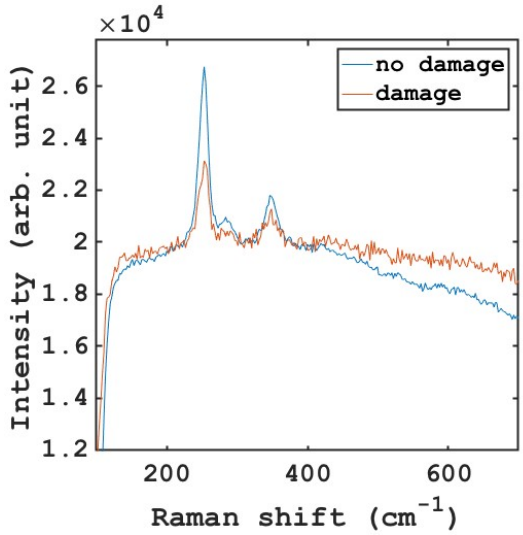

Fig. S5. Raman spectra collected with the micro-Raman 785 set-up collected on non-damaged area (light blue line) and the damaged area (orange line) after irradiation of vermilion oil mock-up with 532 nm laser at 100 mW for 10 s and a spot size of 180 µm. The background was shifted vertically to better visualize the differences in the Raman peaks.

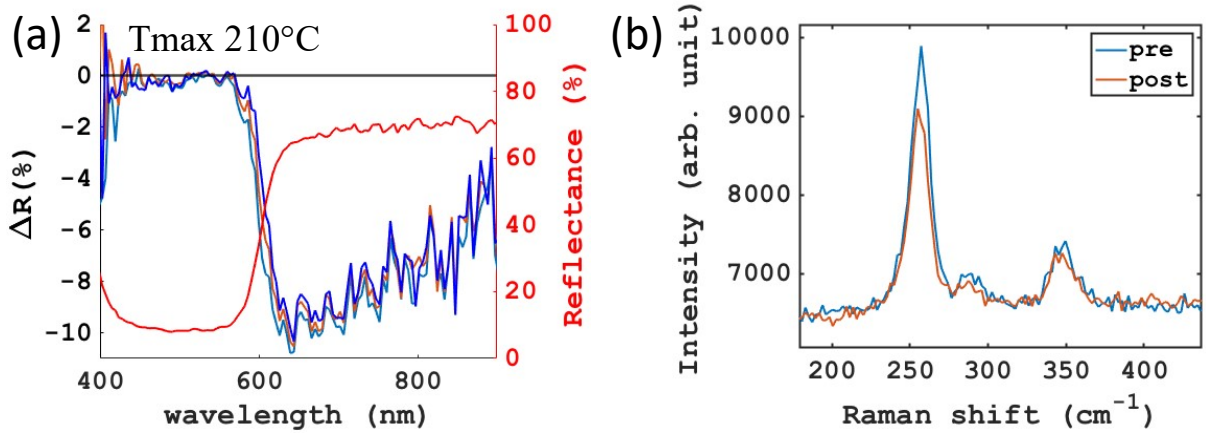

Fig. S6. The irradiation of vermilion pigment powder with 532 nm laser at 100 mW, 10 s and a spot size of 900 µm, reaching a maximum temperature of 210°C. (a) ΔR VIS-NIR spectral changes (1 s light blue, 5 s orange, 10 s yellow, 60 s green, 300 s dark blue post irradiation, in red the reference spectrum before irradiation); (b) the Raman spectra before (light blue) and after (orange) 532 nm laser irradiation collected with the 785 nm Raman system. The background was shifted vertically to better visualize the differences in the Raman peaks.

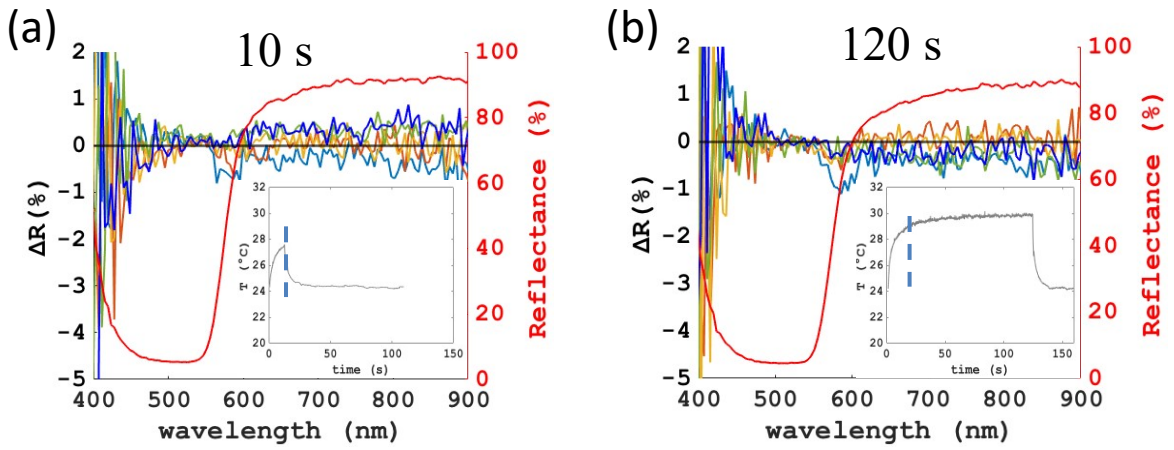

Fig. S7. The effect of prolonged exposure of red lead paint mock-up with 785 nm laser at 100 mW with a spot size of 900 µm for (a) 10 s irradiation time and (b) 120 s. The ΔR VIS-NIR spectral changes (1 s light blue, 5 s orange, 10 s yellow, 60 s green, 300 s dark blue post irradiation, in red the reference spectrum before irradiation). In the insets, the temperature evolution. The dashed light blue line indicates in both graphs the 10 s time stamp.

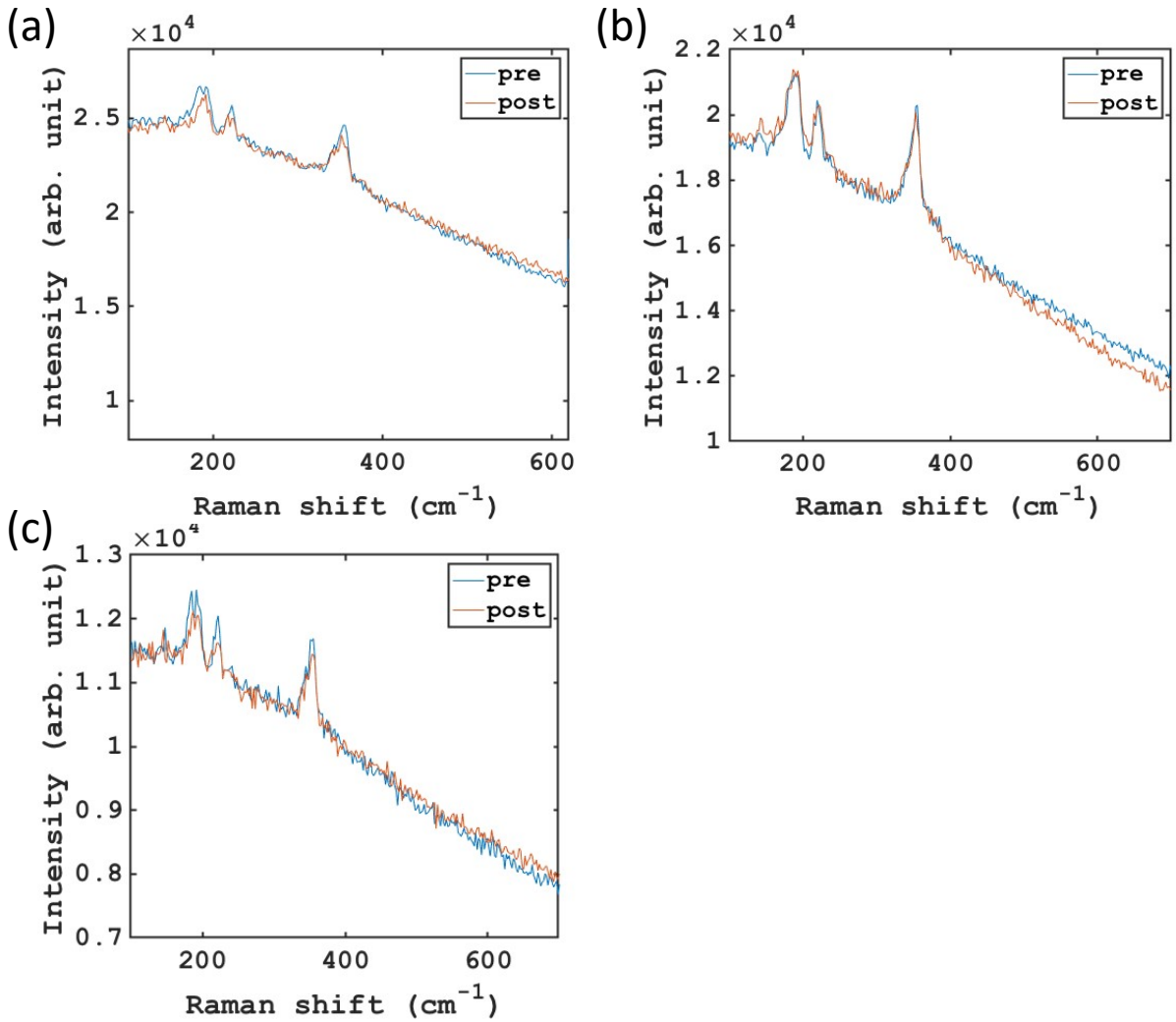

Fig. S8. Raman spectra collected with 785 nm laser before (light blue) and after (orange line) irradiation of realgar oil mock-up with the 532 nm laser and a spot size of 900 µm with a) 100 mW for 10 s; b) 2.8 mW for 10 s; c) 2.8 mW for 450 s. The background was shifted vertically to better visualize the differences in the Raman peaks.

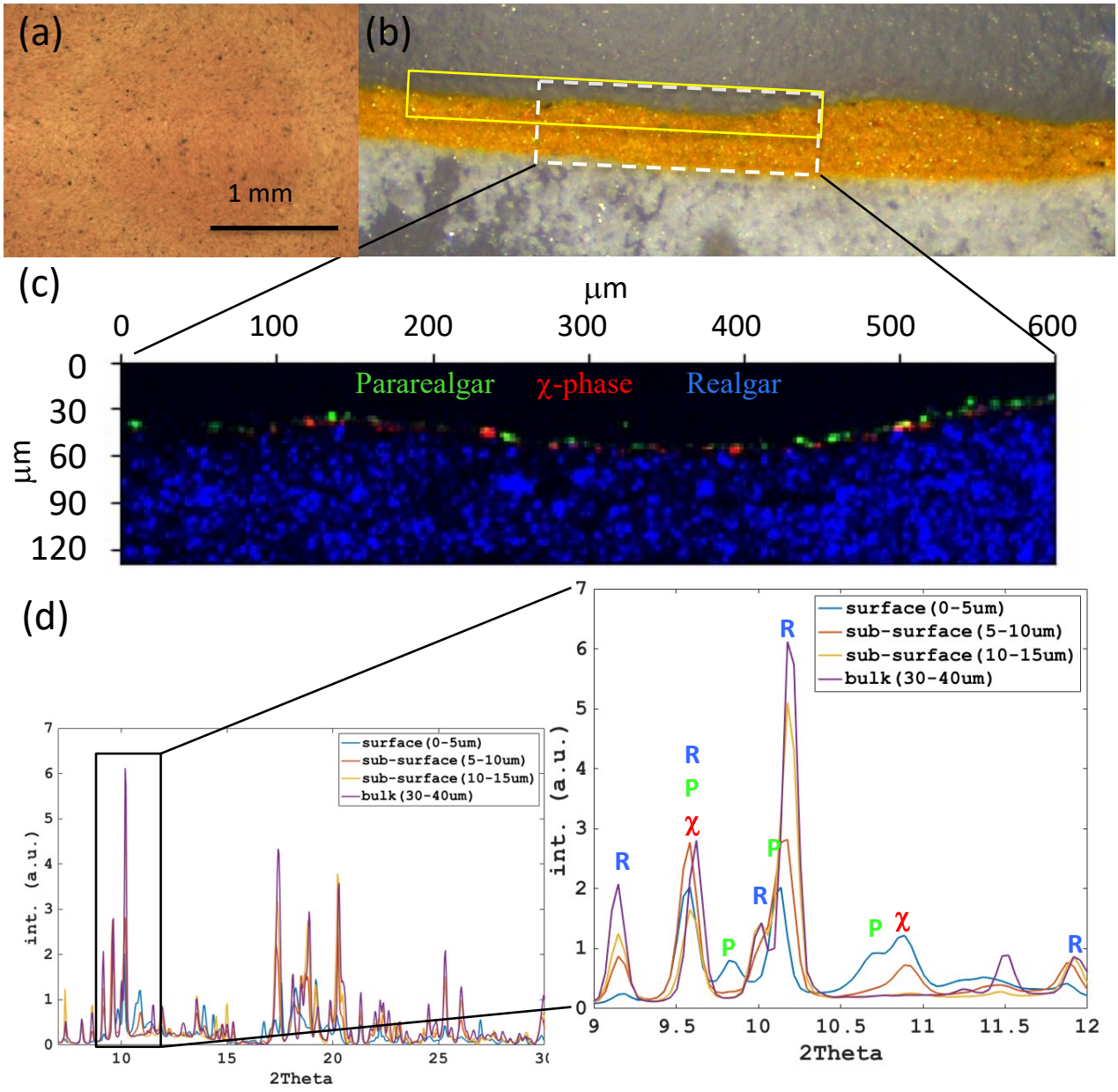

Fig. S9. The structural changes of realgar irradiated with a prolonged exposure with 532 nm laser at 2.8 mW for 450 s with a spot size of 900 µm. (a) optical microscope image, (b) the thin section of 10 µm of the same sample examined by synchrotron (SR) µ-XRPD (yellow box corresponds to laser spot, dashed white rectangle is the analysed area) and (c) the Red/Green/Blue composite SR µ-XRPD map of respectively χ phase/pararealgar/realgar; (d) the average diffraction pattern at different depth of the thin section from the area irradiated by the laser. Realgar (R), pararealgar (P) and the χ phase (χ) were identified.