Supplementary information for

Compression Stiffness of Porous Nanostructures from Self-Assembly of Colloidal Branched Nanocrystals

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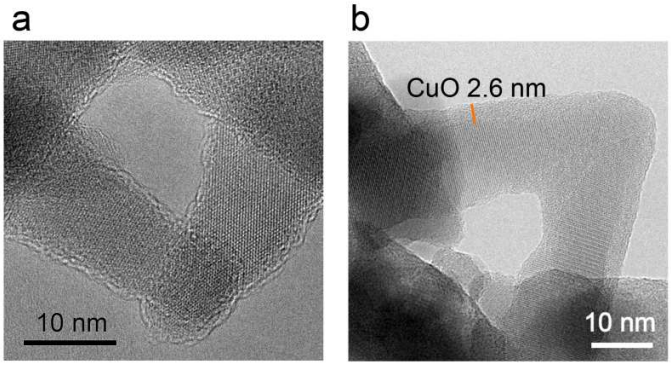

Figure S1. (a): HRTEM image of two pods of neighboring CdSe/CdS octapods; (b): HRTEM image of two pods of neighboring $Cu_2Se/Cu_2S/CuO$ octapods, showing the typical thickness of the copper oxide layer welding them.

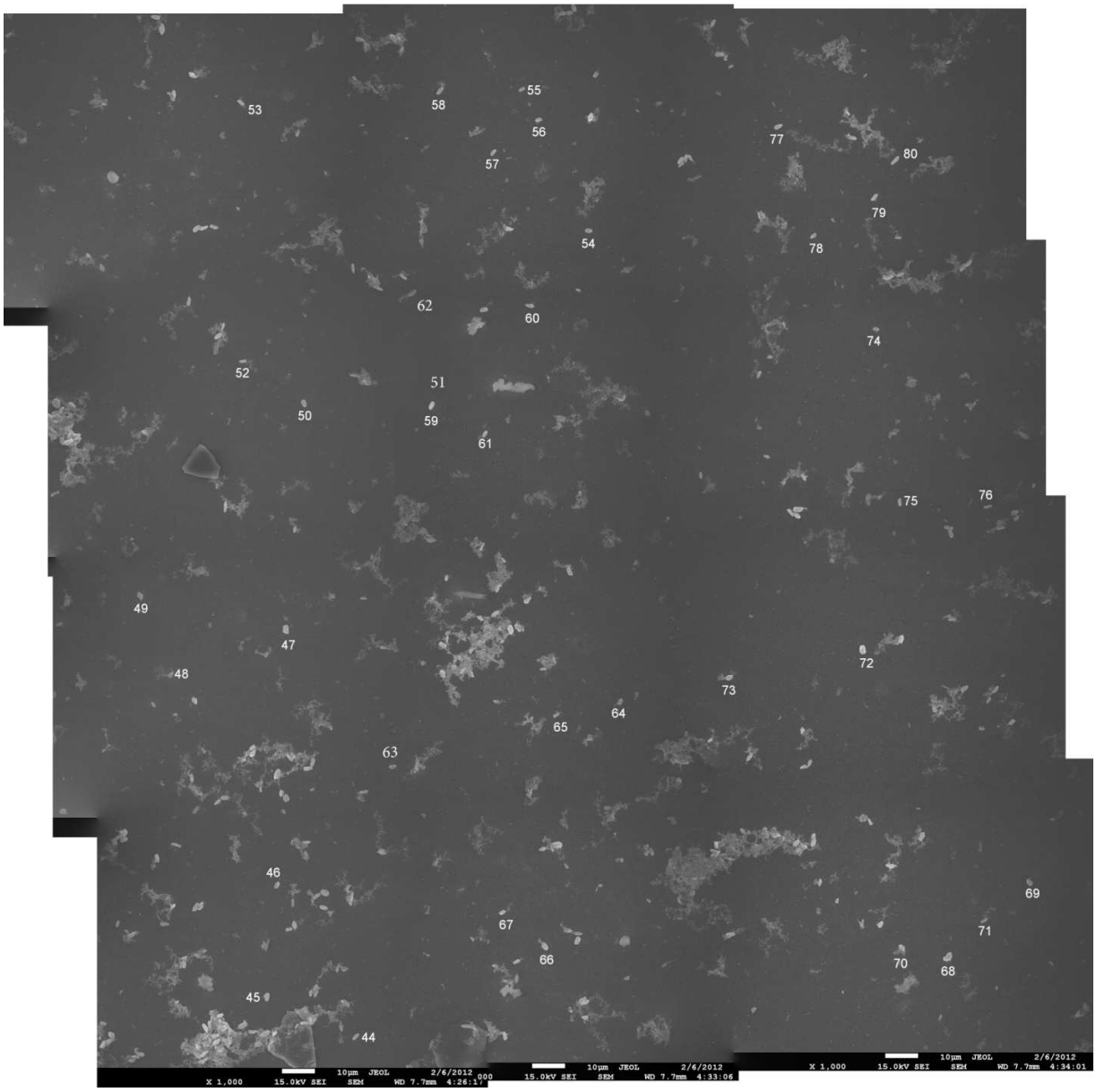

Figure S2. Example of a SEM map of superstructures adapt to be tested by nanocompression.

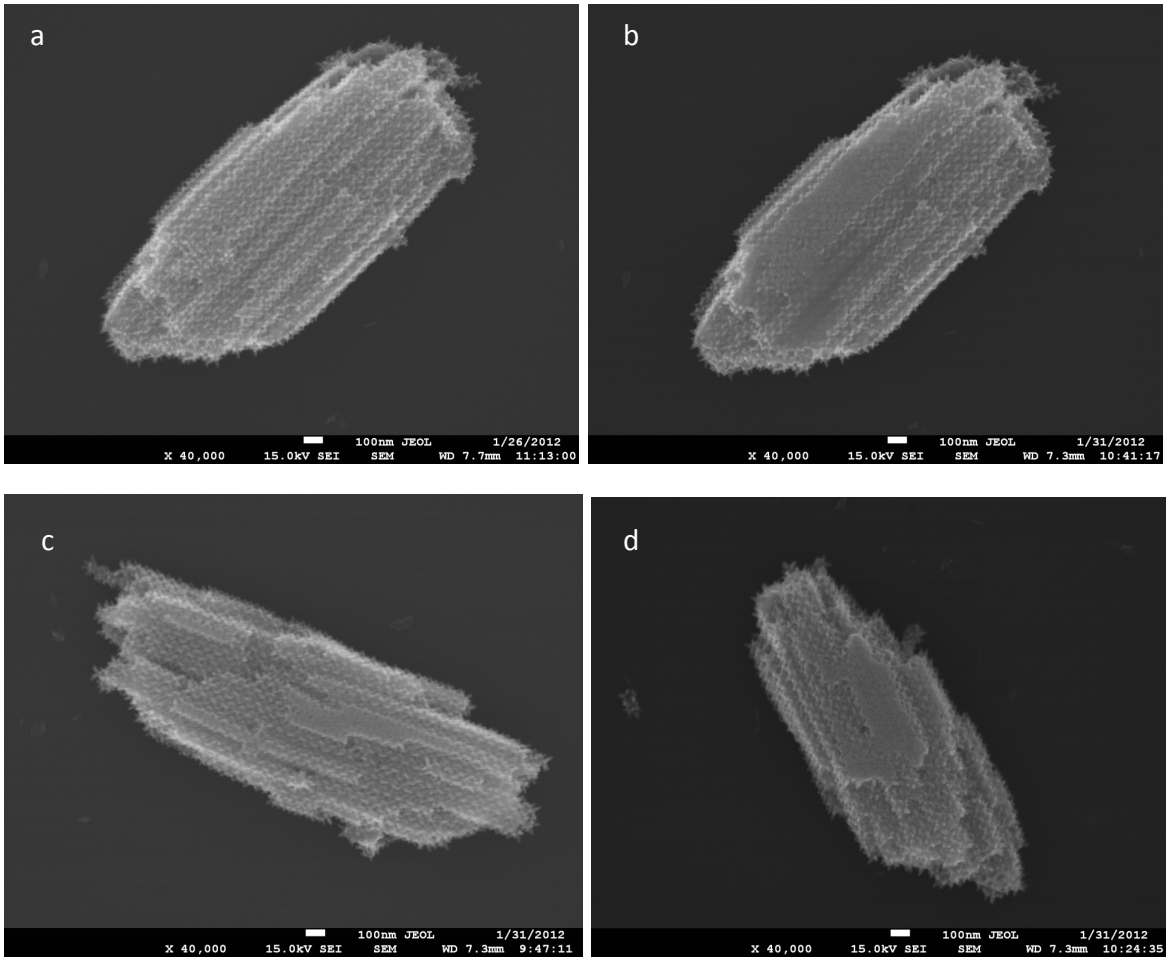

Figure S3 HRSEM images of a superstructure before (a) and after (b) nanocompression at 0.3 mN; (c) and (d): images of superstructures after low load (0.1 mN) compression. The low extent of plastic deformation, limited to small area top layers, is visible.

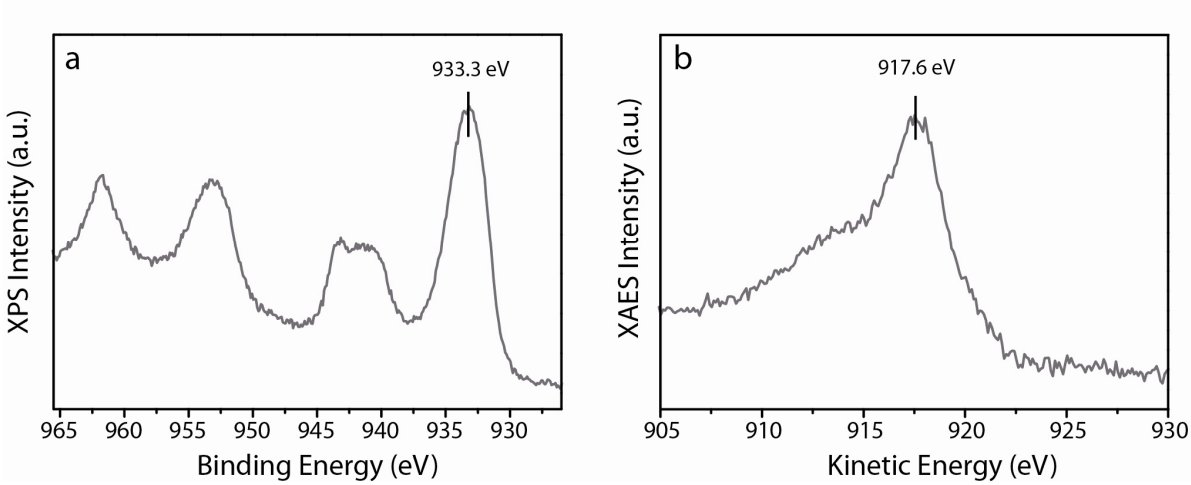

Figure S4. XPS measurements performed on a Kratos Axis Ultra DLD spectrometer, using a monochromatised Al Kα source operating at 15 kV and 20 mA. High resolution narrow scans were performed at constant pass energy of 10 eV and steps of 0.1 eV. The photoelectrons were detected at a take-off angle Φ = 0° with respect to the surface normal. The pressure in the analysis chamber was maintained below 7×10−9 torr for data acquisition. The binding energy (BE) scale was internally referenced to the C 1s peak (BE for C-C = 284.6 eV).
(a): XPS spectrum of Cu 2p peaks, showing the Cu $2p_{3/2}$ peak at (933.3±0.1) eV and the typical satellite features for Cu(II)O (see Biesinger et al. Applied Surface Science 257 (2010) 887–898).
(b): X-ray induced Auger Electron Spectroscopy (XAES) on Cu LMM Auger peak. Again, peak position indicates the presence of Cu(II) species.
No signal in the XPS and XAES characterizations can be related to the presence of Cu(I) species. In the present case the sampling depth, evaluated for photoelectrons of kinetic energy of approx. 550 eV (i.e. electrons coming from Cu 2p level) passing through a CuO layer, is limited roughly to 3 nm. Therefore, keeping in mind the oxide layer thickness as characterized by HRTEM, the XPS signal is only due to the copper oxide shell formed after the plasma oxidation. In conclusion, XPS characterization states that the copper oxide shell is made by CuO.

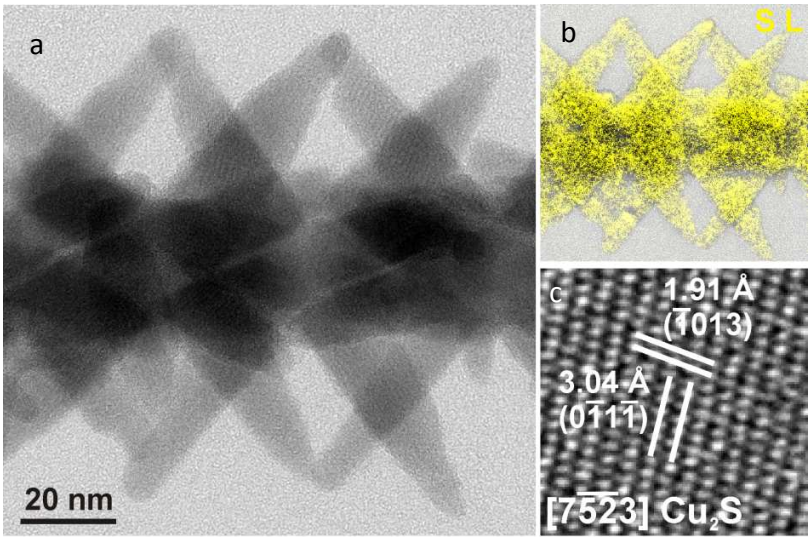

Figure S5 (a) Bright field TEM image of a portion of an octapod chain after Cd^{2+}->Cu^{+} ion exchange and (b) same image with superimposition of EFTEM elemental map of sulfur (yellow). The EFTEM map was acquired using the in-column energy filter (Omega-filter) installed in the JEOL JEM-2200FS microscope, with the three-window method at the S L edge (165 eV onset energy, 20 eV slit width). (c) HRTEM image of a pod, showing the crystal structure of hexagonal Cu_2S (a=3.985 Å, c=6.805 Å, ICSD #200989).

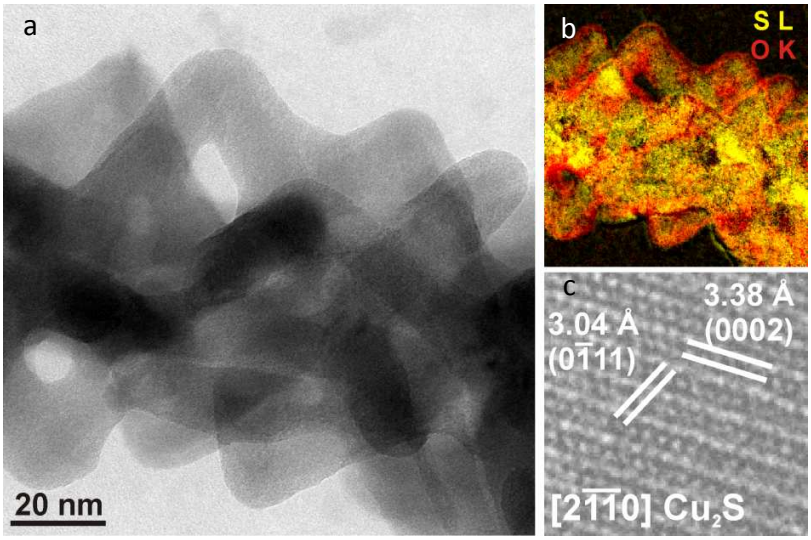

Figure S6 (a) Bright field TEM image of a portion of a welded octapod chain after Cd^{2+}->Cu^{+} ion exchange and O_2 plasma treatment. (b) Combination of EFTEM elemental maps of sulfur (yellow, L edge at 165 eV, 20 eV slit width) and oxygen (red, K edge at 532 eV, 30 eV slit width) acquired with the three-window method. (c) HRTEM image of the core of a pod, showing the crystal structure of hexagonal Cu_2S.