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RESEARCH ARTICLE

# Synthesis of Ag and Cd nanoparticles by nanosecond-pulsed discharge in liquid nitrogen

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## Electronic Supplementary Material

ESM 1

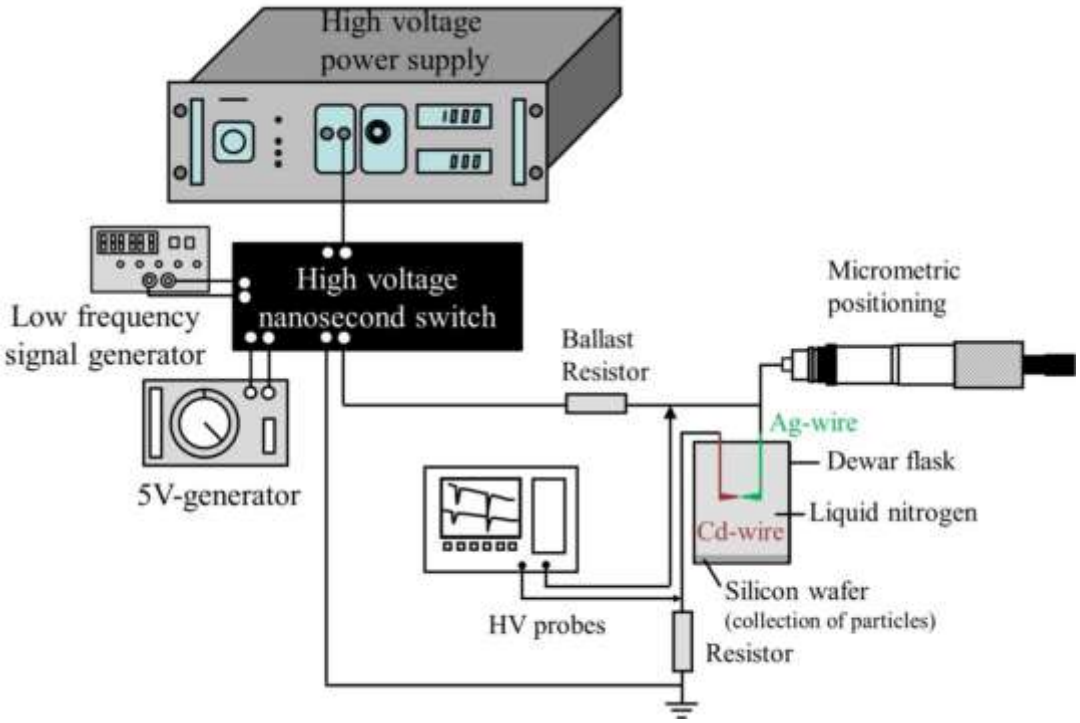


Fig. S1: Experimental setup.

**ESM 2**

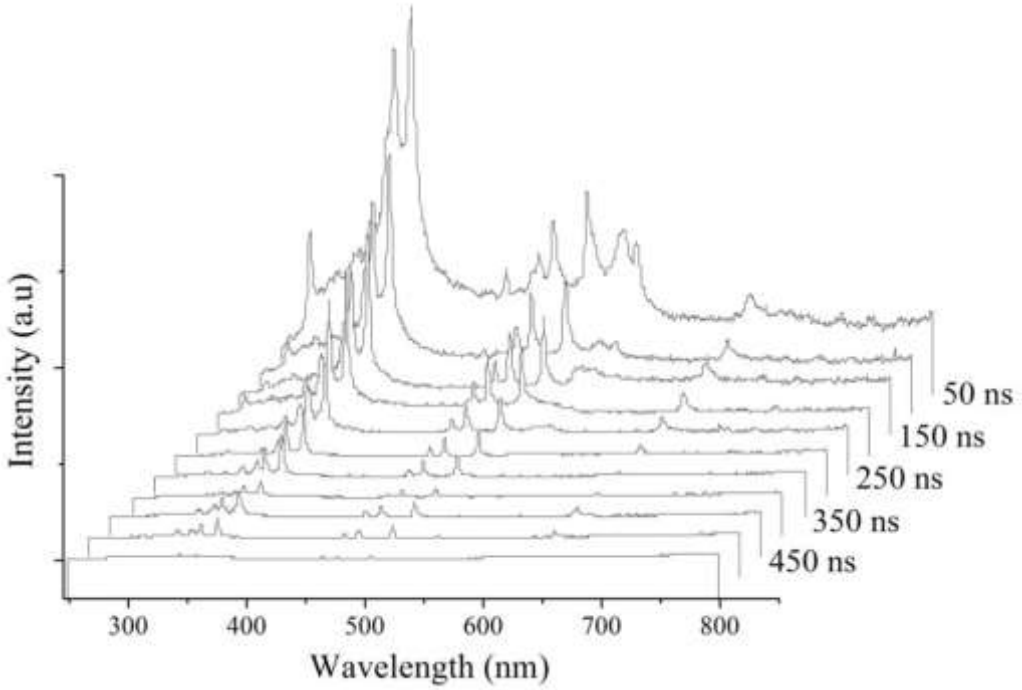


**Fig. S2:** Time-evolution of optical emission spectra between 50 and 550 ns. Acquisition time: 50 ns. Applied voltage: +10 kV. Pulse width: 100 ns.

**ESM 3**

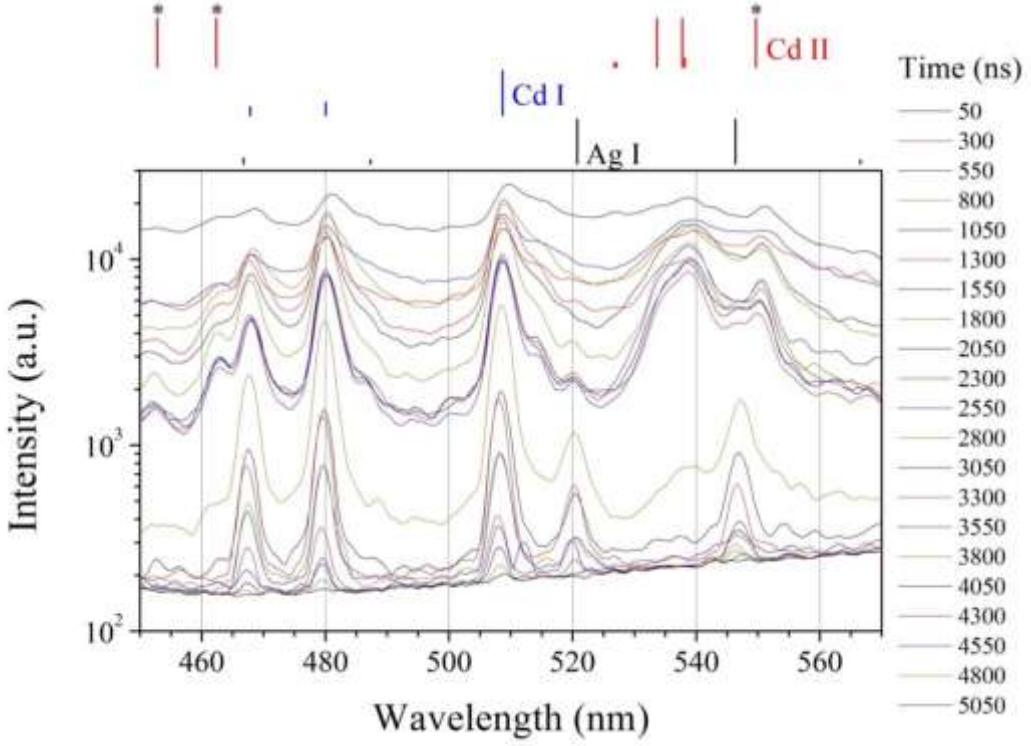


**Fig. S3:** Identification of emission lines between 450 and 570 nm. Theoretical transitions are materialized by ticks with a height proportional to their relative intensity normalized to the maximum value in the visible range. Acquisition time: 50 ns. Applied voltage: +10 kV. Pulse width: 2500 ns. Cd I, Cd II and Ag I transitions are clearly present. Stars indicate second- order Cd II transitions. Note that the shoulder visible on the red wing of the Cd I transition at

508.58 nm is either due to the Ag I line at 512.35 nm (its relative intensity is 1.5% of the Ag I line at 520.91 nm) or to the Cd I line at 515.47 nm (its relative intensity is 0.6% of the Cd I line at 508.58 nm).

**ESM 4**

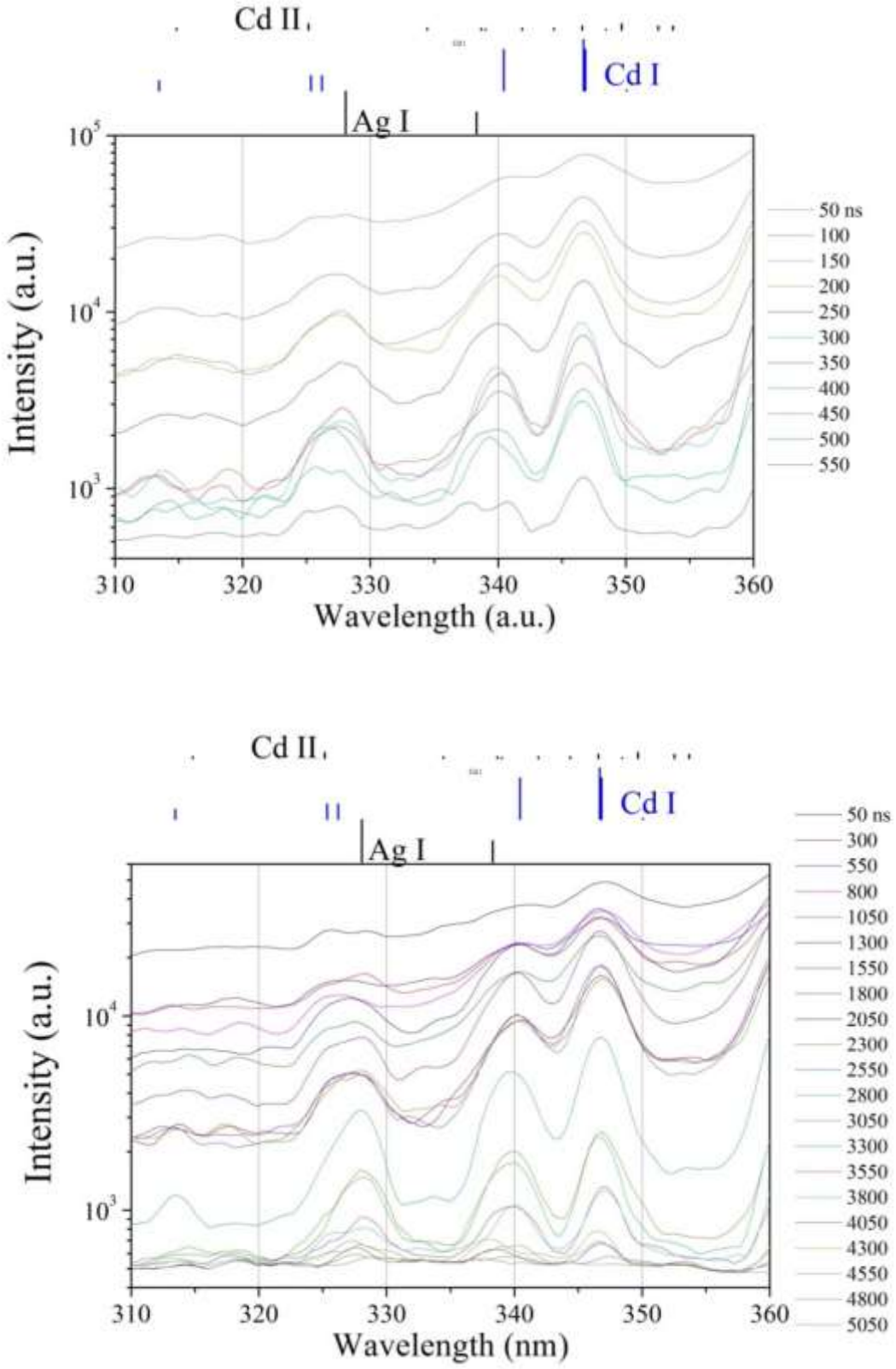


**Fig. S4:** Time-evolution of emission lines of silver at 328.07 and 338.29 nm for pulse widths of 100 ns a) and 2500 ns b). Theoretical transitions are materialized by ticks with a height proportional to their relative intensity normalized to the maximum value in the visible range. Applied voltage: +10 kV.

**ESM 5**

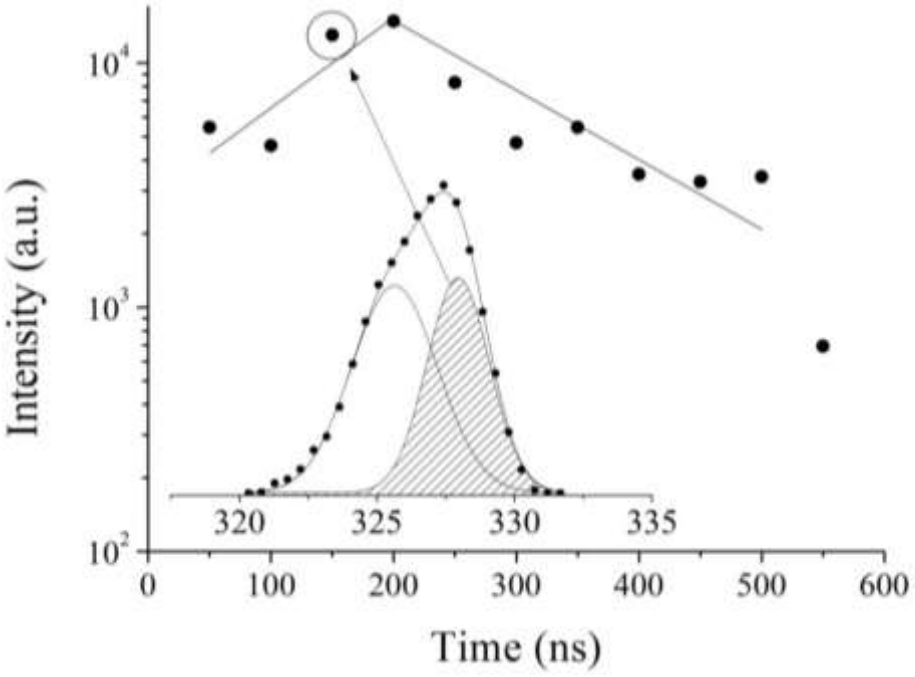


**Fig. S5:** Time-evolution of the area of the emission line of silver at 328.07 nm. A single peak at 325.6 nm was used to simulate the contributions of Cd I at 325.25 and 326.11 nm whose relative intensities are equal.

**ESM 6**

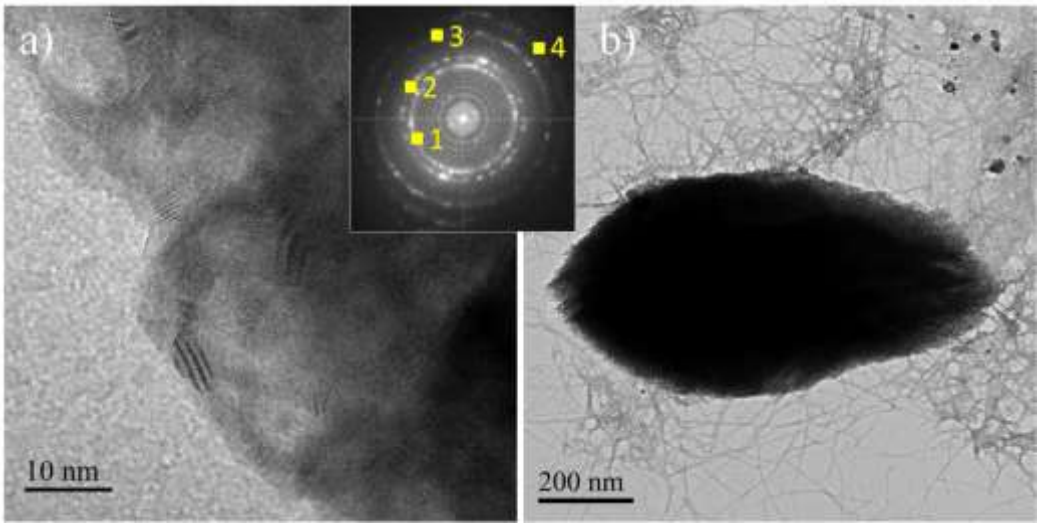


**Fig. S6:** a) High Resolution (HR-)TEM micrograph of the tip of a slightly stretched cadmium nanoparticle with the corresponding fast Fourier transform analysis of the selected area. dot1: (111). dot2: (200). dot3: (220). dot4: (222). b) Large view image of the studied cadmium particle. The white square at the tip of the particle represents the magnified area showed in figure a).

**ESM 7**

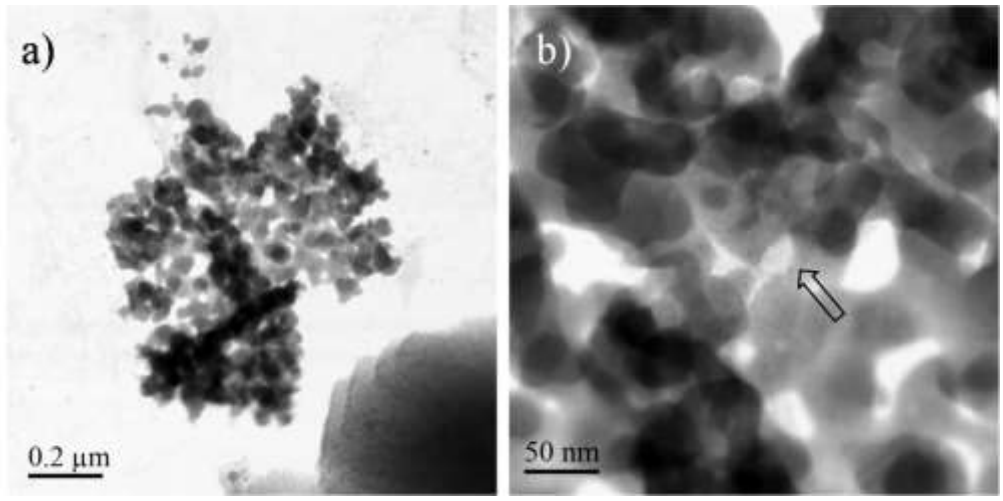


**Fig. S7:** a) STEM bright field micrograph of a silver cluster. b) Idem at higher magnification. We notice the presence of tiny nanoparticles of cadmium in the middle of the picture (arrow).

**ESM 8**

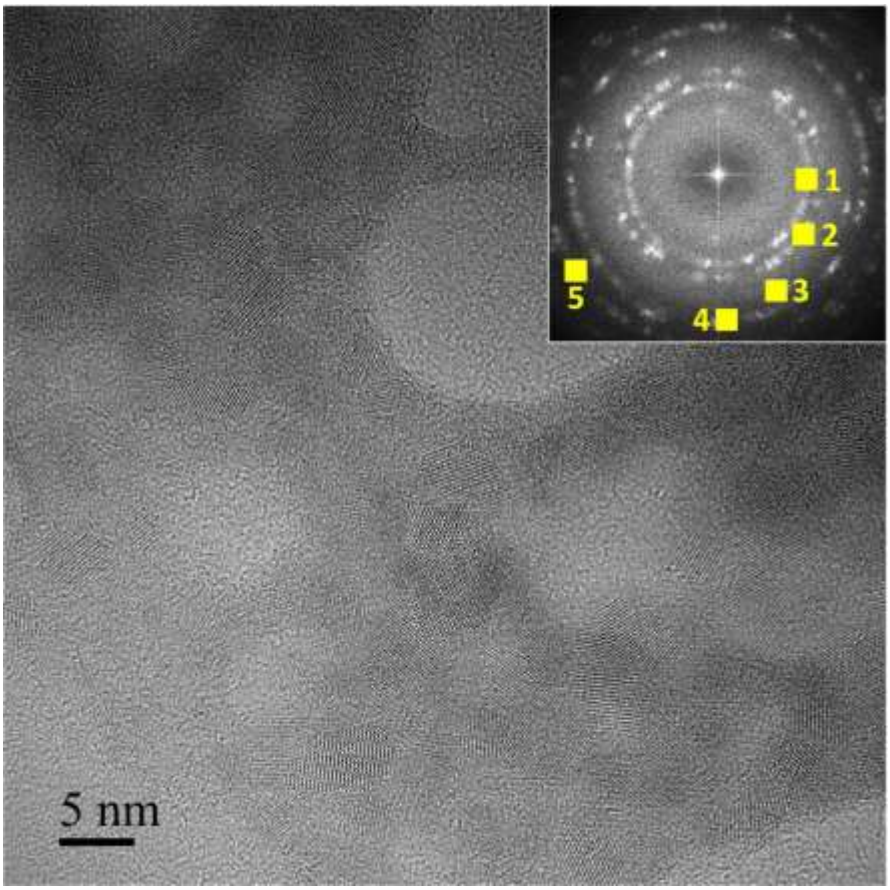


**Fig. S8:** a) High Resolution (HR-)TEM micrograph of $Ag_2O$ nanoparticles with the corresponding fast Fourier transform analysis of the selected area. dot1: (100). dot2: (200). dot3: (211). dot4: (220).Dot5: (311).

**ESM 9**

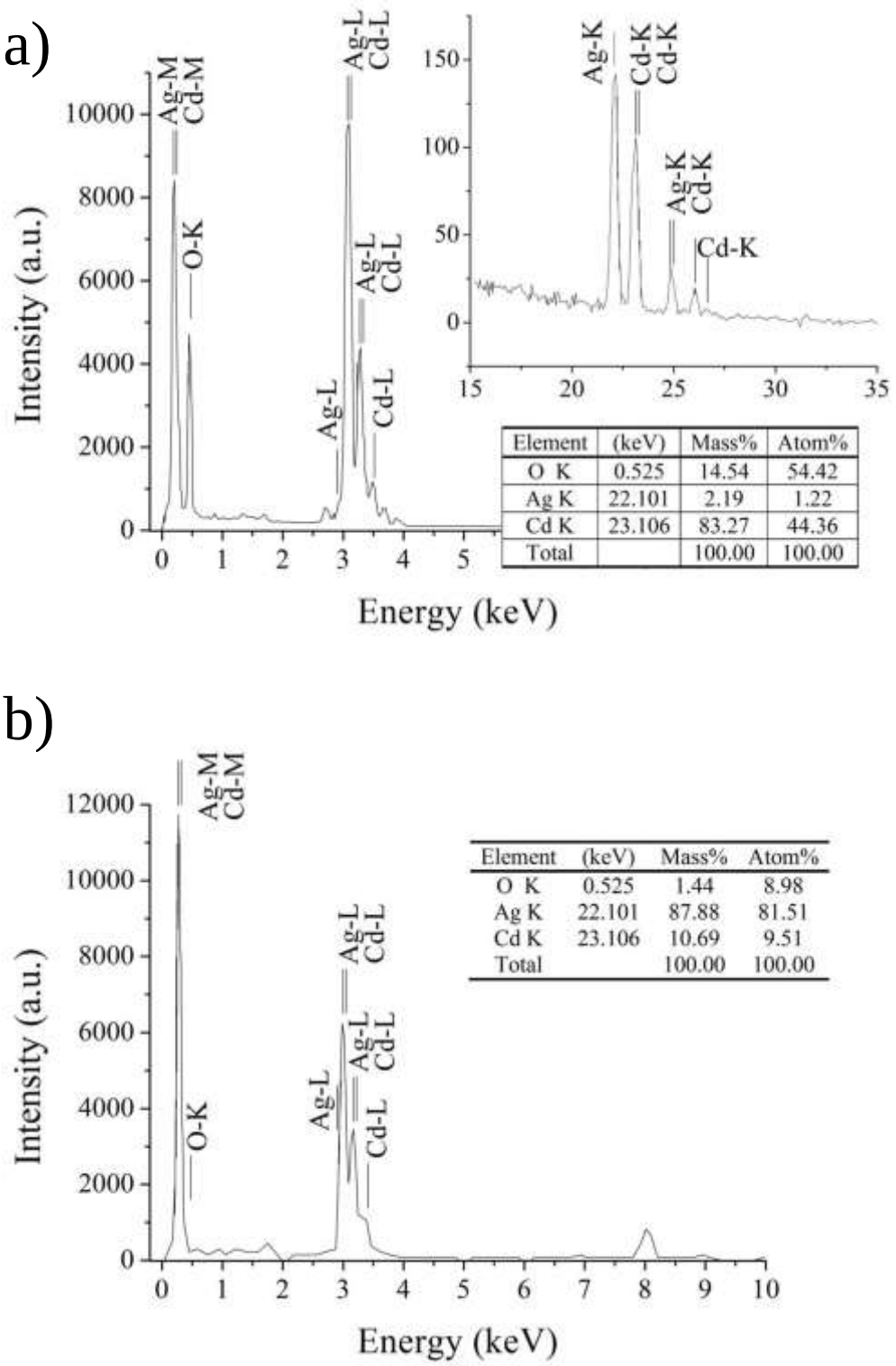


**Fig. S9:**a) Typical EDS spectrum of a CdO object with traces of silver, certainly due to spread Ag-nanoparticles. The quantification must be done with Ag-K and Cd-K transitions at 22 and 23 keV because other transitions overlap. b) Typical EDS spectrum of an Ag object with traces of CdO, certainly due to spread Cd-nanoparticles (see **Fig. S10b**).

**ESM 10**

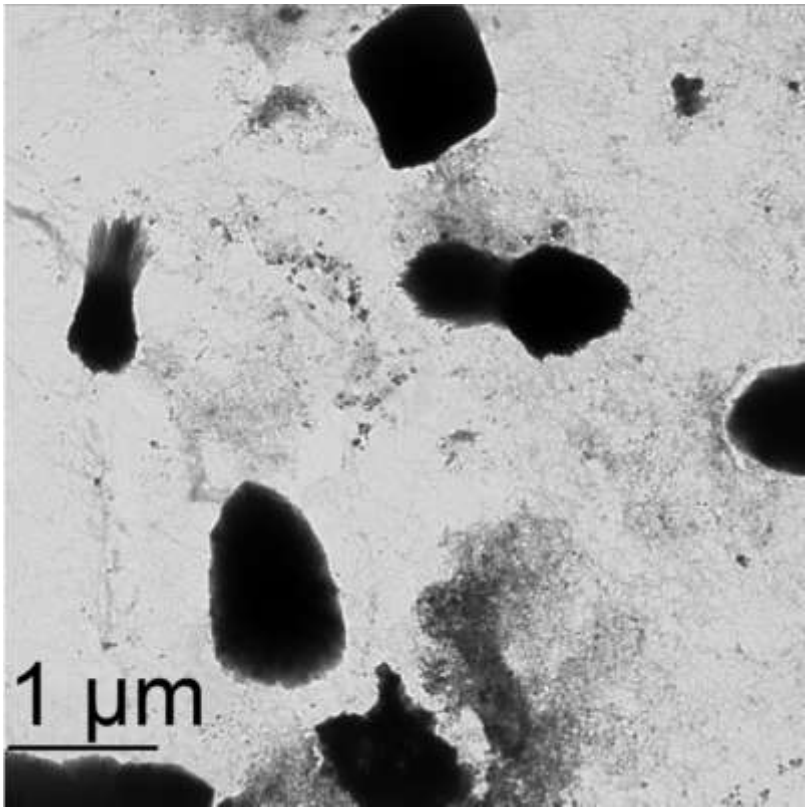


**Fig. S10:** Examples of CdO nano-objects with elongated shapes with both ends getting filamentary. Synthesis conditions: pulse width: 500 ns. Applied voltage: 10 kV.

**ESM 11**

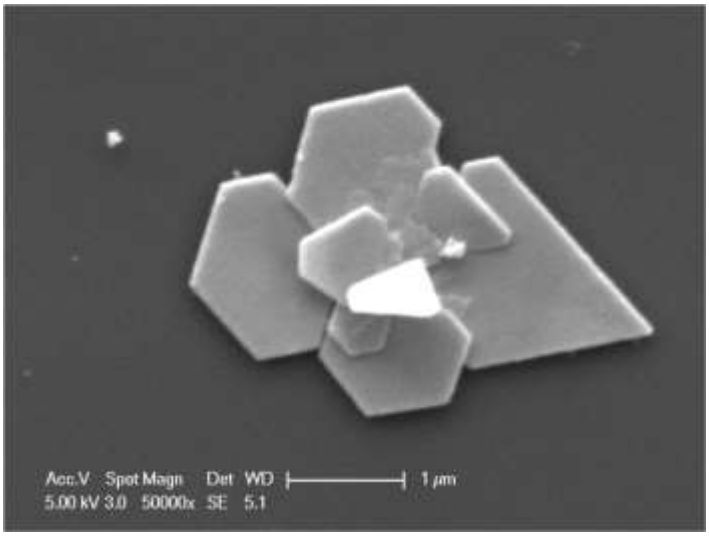


**Fig. S11:** Synthesis of silver 2D-objects between two pure silver electrodes. Applied voltage: 10 kV. Gap distance: 100 µ m. Pulse width: 100 ns.