

**Supplementary Information for the Manuscript:**

**Heterogeneous phase formation in diluted magnetic semiconducting  
 $\text{Zn}_{1-x-y}\text{Co}_x\text{Al}_y\text{O}$  (CAZO) nanoparticles**

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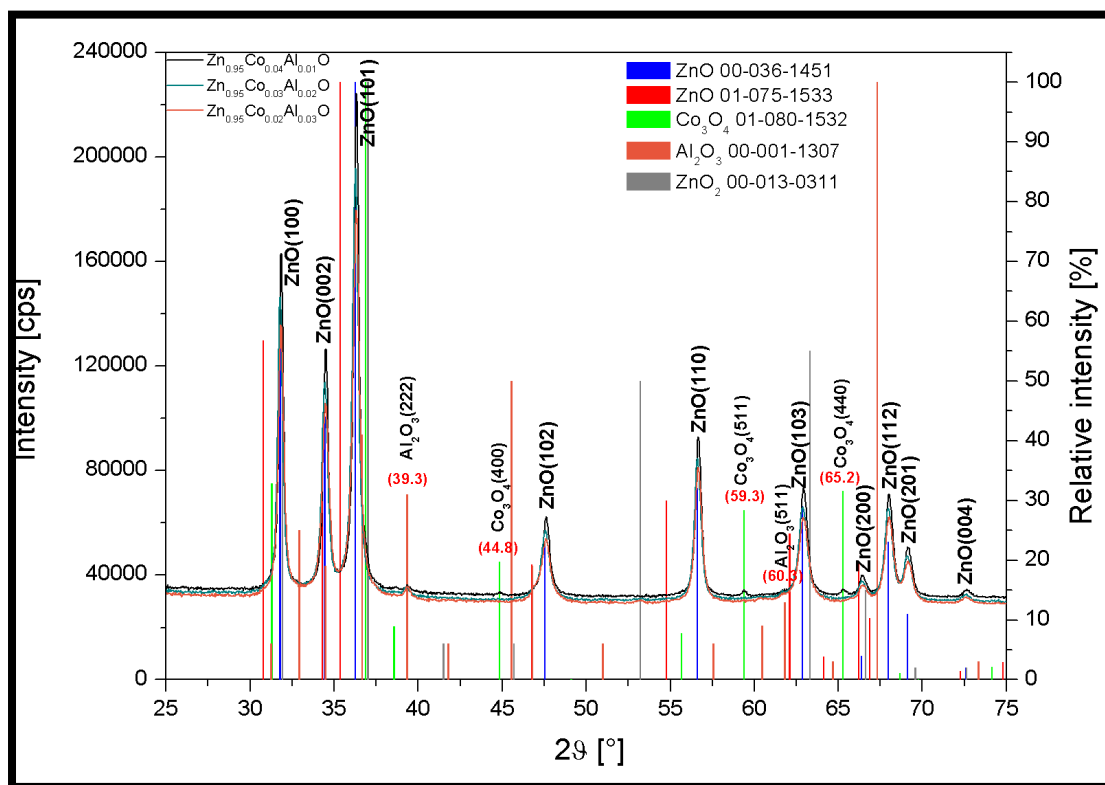
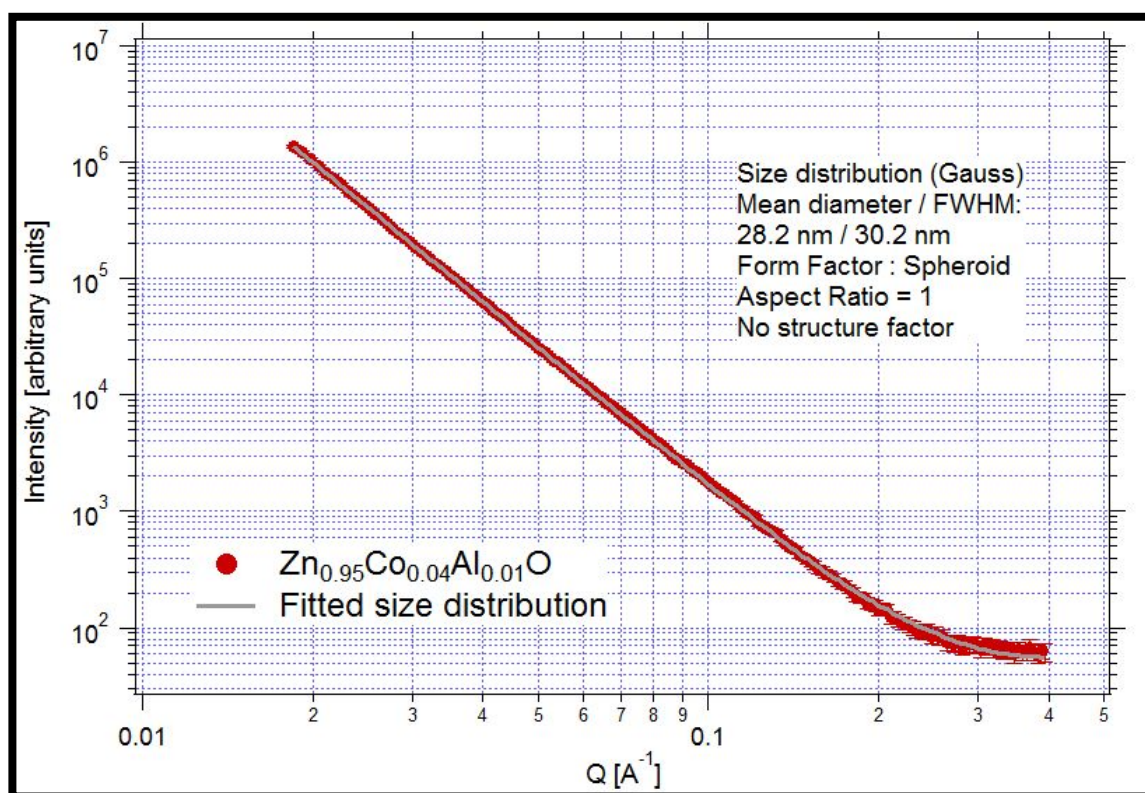


Figure S1. XRD pattern of the CAZO nanocrystals



**Figure S2.** Particle size distribution (Gauss) profile fit to the SAXS spectrum of the  $\text{Zn}_{0.95}\text{Co}_{0.04}\text{Al}_{0.01}\text{O}$  using *Irena* program.

Using the *Irena* program, the size distribution (using the Gauss distribution) fitting to the measured SAXS curves was performed (for details the reader is referred to the freely available *Irena* manual). However, the fits are not unique because the spectra do not exhibit any peaks or “knees” (shoulders) which are typical for the SAXS spectra when small nanostructures are present. The same curve can be fitted very well with a distribution of particles with an average size e.g. by two orders of magnitude higher. Such fitting has obviously no sense but the minimum possible average particle/structure size which fits the measured SAXS curves well. Such a distribution is shown in **Figure S2** corresponding to the mean particle size of 28 nm with

FWHM of the distribution around 30 nm ( $\pm 15$  nm). Distributions with lower average particle size start to deviate from the measured curve near the low- $q$  limit. This means that based on the measured SAXS curves it can be stated that the average particle size must be bigger than about 28 nm. However, the real average particle size can be higher which was seen in the TEM pictures (larger crystallites, agglomerates). Similar results were observed for all other samples. The lowest possible average particle size resulting from the fitting is given by the lower limit of the  $q$ -range of the experimental setup.

Supplementary Information S3.

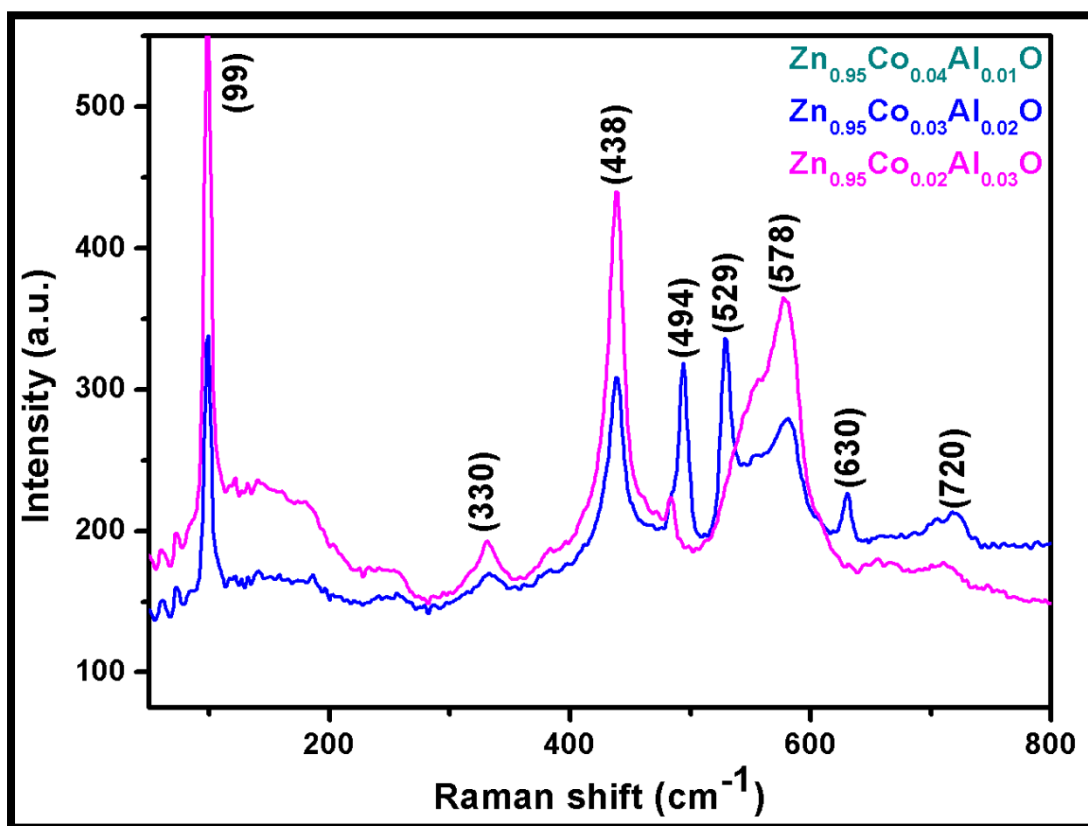
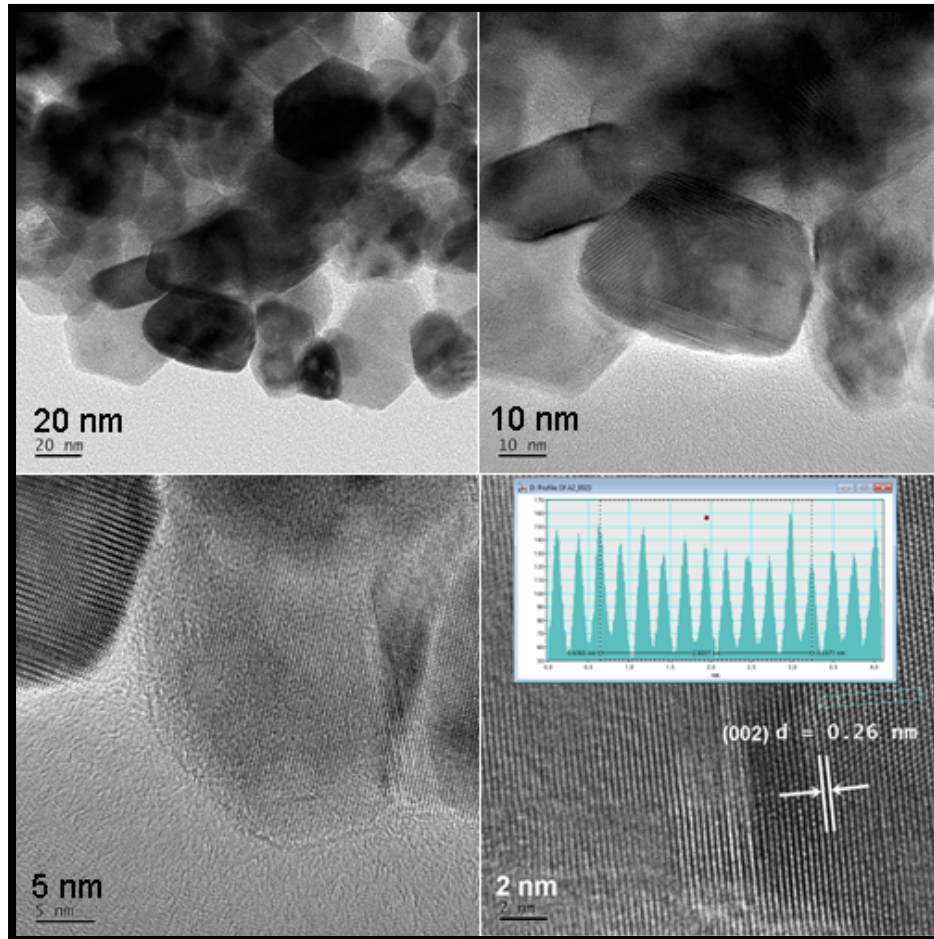


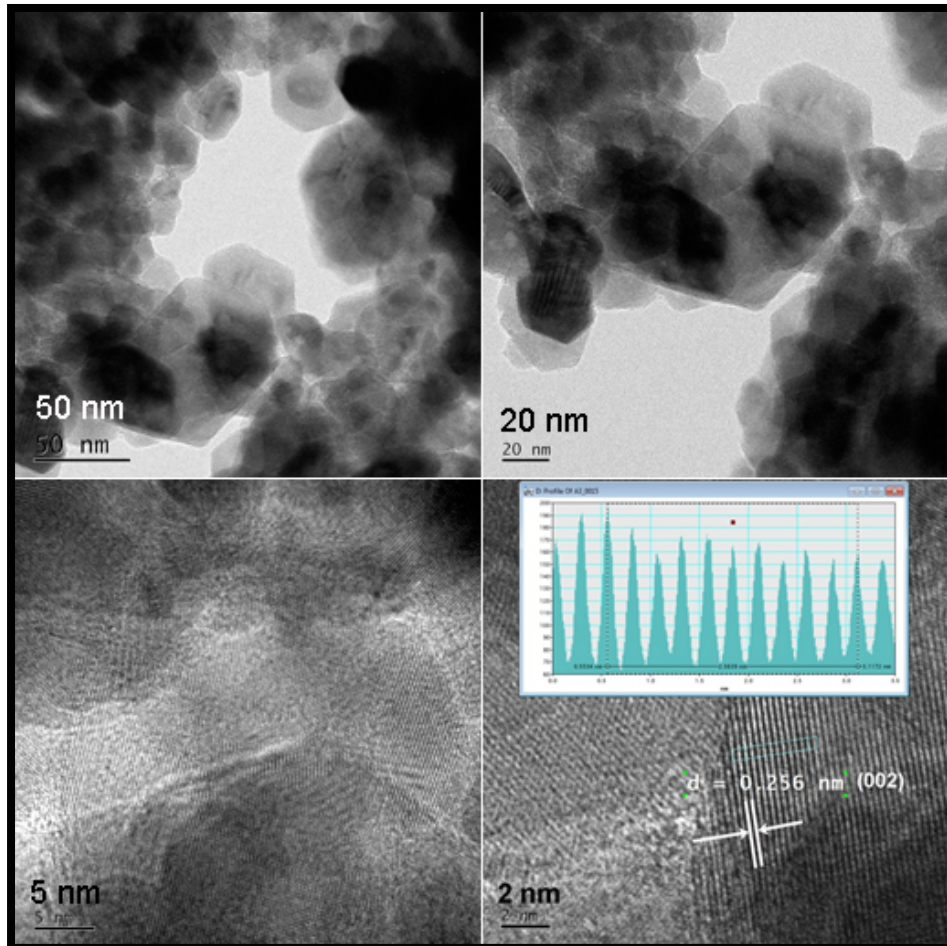
Figure S3. RAMAN spectra of the CAZO nanoparticles.

**Supplementary Information S4.**



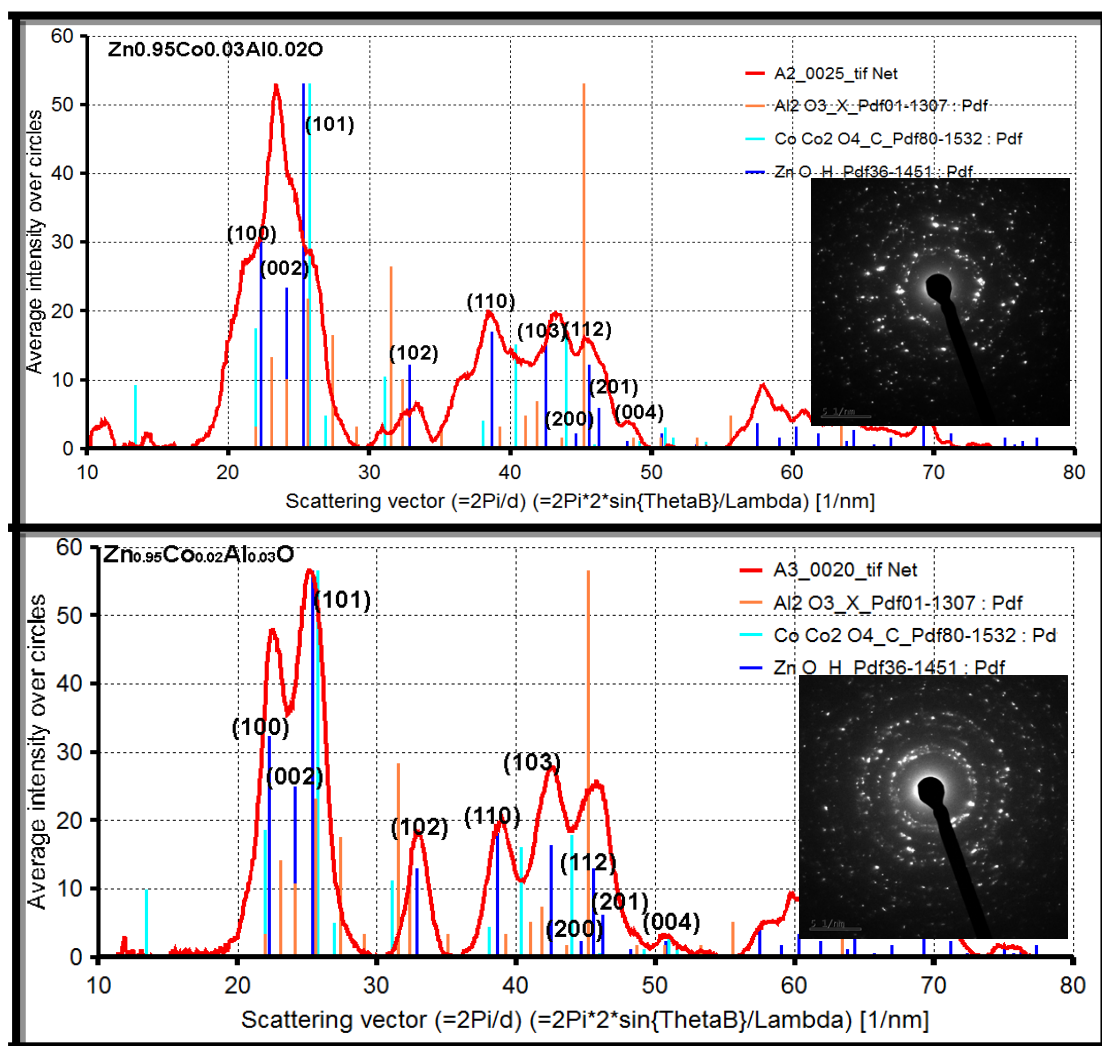
**Figure S4.** HR-TEM micrographs of the Zn<sub>0.95</sub>Co<sub>0.03</sub>Al<sub>0.02</sub>O nanocrystals

**Supplementary Information S5.**



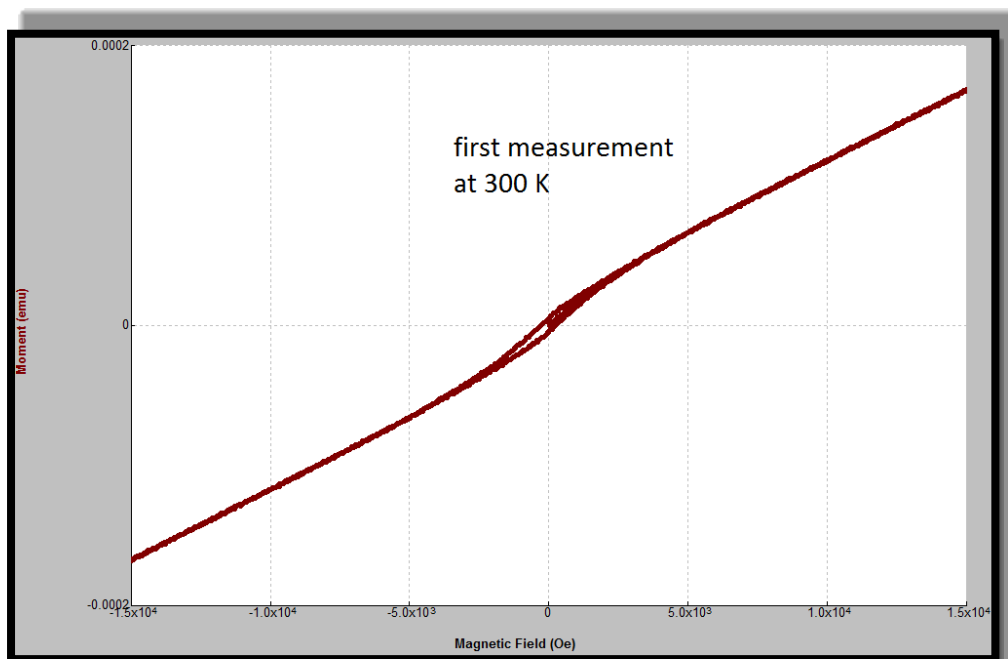
**Figure S5.** HR-TEM micrographs of the Zn<sub>0.95</sub>Co<sub>0.02</sub>Al<sub>0.03</sub>O nanocrystals

## Supplementary Information S6.



**Figure S6.** A plot of comparison between selected area electron diffraction pattern of CAZO nanocrystals with standard ZnO X-ray diffraction pattern





**Figure S7.** Room temperature ferromagnetic hysteresis curve for the  $\text{Zn}_{0.95}\text{Co}_{0.02}\text{Al}_{0.03}\text{O}$  nanoparticles calcined at 600°C.