

#### Investigating the Lower Size Limit of the ViewSizer 3000 with 10 nm Silver Nanoparticles

##### Introduction

The ability to measure nanoparticles down to 10 nm is becoming more and more important to numerous fields as processes and products become more refined and demand for higher resolution particle size distribution data increases.

In this application note, the ViewSizer 3000 was used to measure 10 nm silver nanoparticles confirmed by sizing from transmission electron microscope (TEM) images.

##### Analytical Test Method

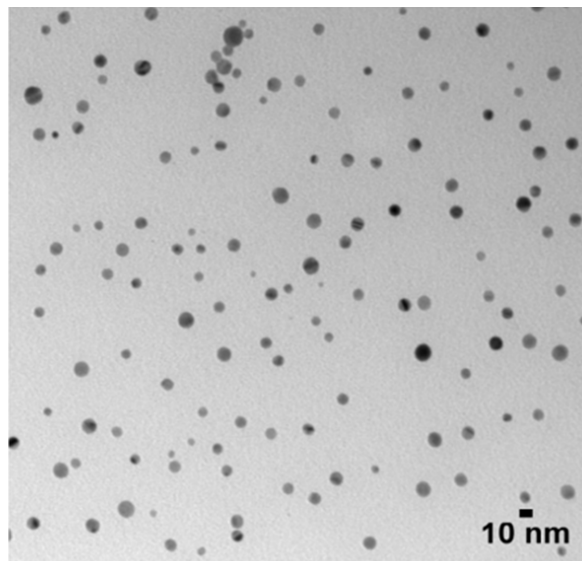
Particle size distribution was determined with a HORIBA ViewSizer 3000 utilizing the multispectral nanoparticle tracking analysis method.

##### Method

- o Cell: Quartz cuvette
- o Blue laser power: 250 mW
- o Green laser power: 12 mW
- o Red laser power: 8 mW
- o Gain: 36 mW
- o Exposure: 32 ms
- o Dilution: 10,000x
- o Processing: Polydisperse with override settings
- o Feature radius: 40 pixels

##### Test Procedure:

1. Dilute sample 10,000x in XZero ultrapure water.
2. Add sample to cuvette with insert and stir bar and insert cuvette into instrument.
3. Allow cuvette to thermally equilibrate at 22°C for 2-3 minutes.
4. Record 25 videos and process with polydisperse override settings.
5. Repeat measurement two more times on same sampling.



**Figure 1.** Transmission electron microscope (TEM) images of  $9.9 \pm 1.9$  nm silver nanoparticles (nanoComposix, 0.02 mg/mL).

## Particle Size Distribution Results

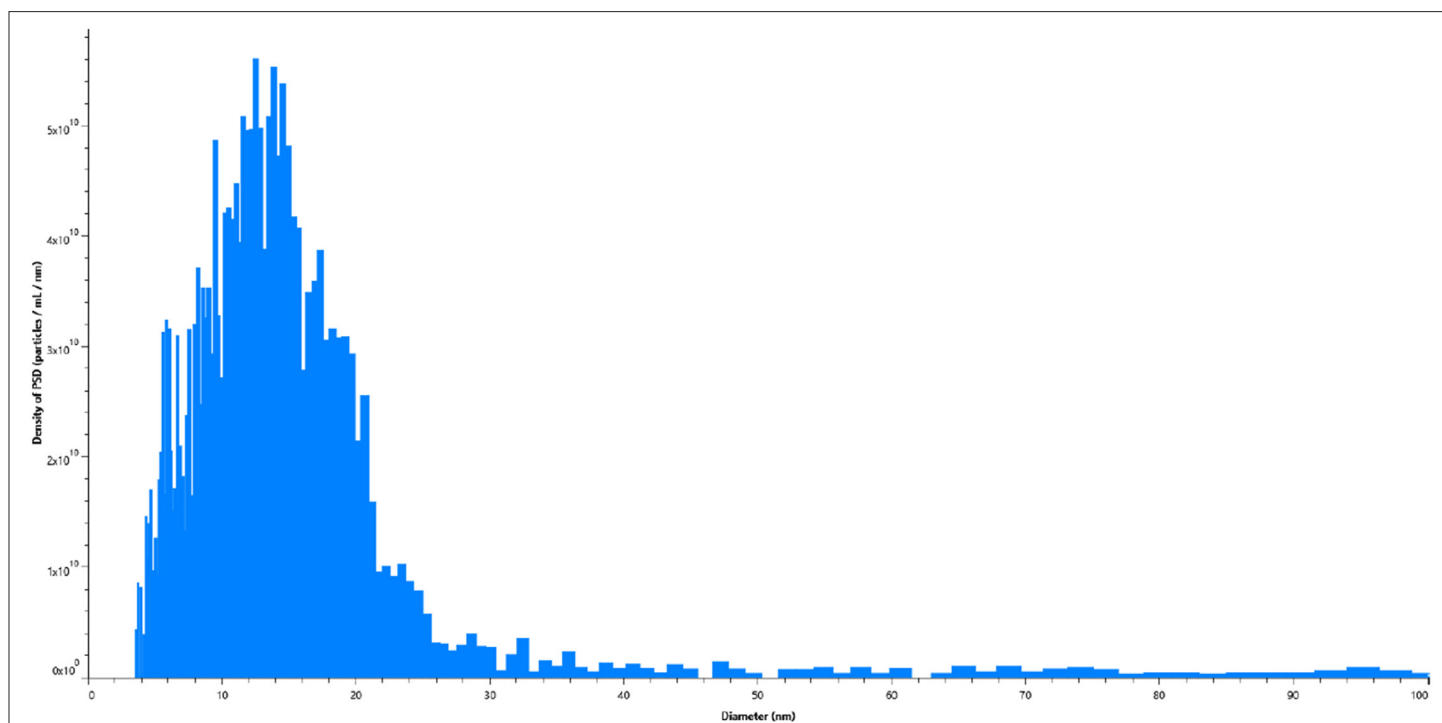


Figure 2. Particle size distribution graph of 10 nm silver nanoparticles.

Sample	D10 [nm]	D50 [nm]	D90 [nm]
10nm Ag_01	7.16	13.68	23.78
10nm Ag_02	6.93	13.89	28.91
10nm Ag_03	7.45	13.91	28.91
Average	7.18	13.83	27.20
CV (%)	3.63%	0.92%	10.89%

Table 1. Particle size distribution data of 3 repeat measurements on 10 nm silver nanoparticles.

### Discussion

The average D50 value of 13.83 nm is quite close to the hydrodynamic diameter of 14 nm according to the CoA<sup>1</sup> and is slightly above the TEM reported diameter of  $9.9 \pm 1.9$  nm, but since NTA reports hydrodynamic size, the results match quite well. The increased hydrodynamic size compared to the core metallic particle size measured by TEM is due to the citrate shell stabilizing these particles. Due to the low electron density, the citrate is not readily imaged in TEM even though it adds to particle drag, affecting hydrodynamic size.

### Conclusion

The ViewSizer shows the sensitivity to be able to measure particles down to 10 nm when the refractive index of the particle is high enough, like with silver, and does so with excellent repeatability. It also shows excellent resolution capability in being able to detect trace amounts of agglomerates, something that sizing through TEM images struggles in capturing with strong enough statistics.

### References

1. <https://cdn.shopify.com/s/files/1/0257/8237/files/AG10-NX-CIT-SS-ECP1606.pdf>