

# In Situ Determination of Colloidal Gold Concentrations with UV–Vis Spectroscopy: Limitations and Perspectives

Thomas Hendel, Klaus Rademann, Jörg Polte

Centro de Física de Materiales, Paseo Manuel de Lardizabal 5, 20018 Donostia – San Sebastián, Spain  
[thomas\\_hendel001@ehu.eus](mailto:thomas_hendel001@ehu.eus)

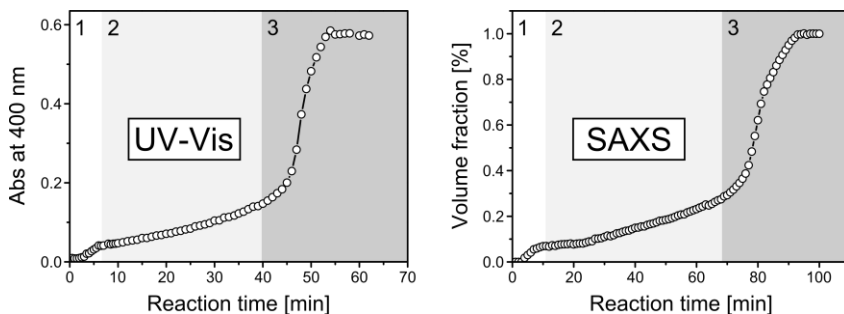
The Au(0) concentration in a gold nanoparticle (GNP) solution represents an important information. However, its exact determination often remains a major issue but is crucial for biological applications and their related toxicological discussions. Moreover, for investigations of GNP formation mechanisms, various GNP surface modifications and particle assembling procedures, accurate Au(0) concentration values are required.

In this work the UV–vis absorbance of colloidal gold nanoparticles at 400 nm is studied and validated as a method to determine Au(0) concentrations in GNP solutions. The method is shown to be valid with restrictions depending on the investigated system. The uncertainty of the determined Au(0) concentration can be up to 30%. This deviation is the result of the combined influence of parameters such as particle size, surface modification, or oxidation state. However, quantifying the influence of these parameters enables a much more precise Au(0) determination for specific systems. As an example, the reduction process of the well-known Turkevich method (citrate reduction) was monitored and the Au(0) concentration was determined with a deviation of less than 5%. Hence, a simple, fast, and cheap in situ method for Au(0) determination in GNP solutions is demonstrated that has in the presence of other gold species such as Au(III) an unprecedented accuracy.

## References

- [1] T. Hendel, M. Wuiherschick, F. Kettemann, A. Birnbaum, K. Rademann, and J. Polte, *Analytical Chemistry*, 86, 22 (2014) 11115-11124

## Figures



**Figure 1:** Left: Time-resolved UV–vis measurements of the absorbance at 400 nm for a GNP synthesis using citrate reduction. Right: The results are compared to the volume fraction derived from SAXS measurements.