

Anion photoelectron spectroscopy of thiolate-protected gold cluster anions formed by matrix-assisted laser desorption/ionization

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Keywords: Cluster; Metal; Matrix-assisted Laser Desorption/ionization; Gas Phase Spectroscopy, DCTB

Gold clusters protected by ligands or stabilized by polymers have attracted increasing attention due to their unique properties that differ from those of the bulk gold. Recently, we have successfully isolated the chemically synthesized Au clusters in vacuum by electrospray ionization (ESI) method and probed their superatomic electronic structures by anion photoelectron spectroscopy (PES).¹ However, the ESI-PES measurements have been limited to ligand-protected Au clusters which are originally negatively charged. In this study, we aim to extend the applicability of PES to neutral clusters and polymer-stabilized clusters, by incorporating a home-built matrix-assisted laser desorption/ionization (MALDI) source into the PES apparatus (Figure 1). The newly designed MALDI source consists of a movable sample plate and an accelerating electrode that also serves as an ion lens. The solid sample of a representative gold cluster, $[\text{Au}_{25}(\text{SC}_2\text{H}_4\text{Ph})_{18}]^-$, was ionized by the MALDI method by using DCTB (*trans*-2-[3-(4-*tert*-Butylphenyl)-2-methyl-2-propenylidene]malononitrile) as a matrix.² The PE spectrum of $[\text{Au}_{25}(\text{SC}_2\text{H}_4\text{Ph})_{18}]^-$ generated by the MALDI agreed well with that generated by the ESI. The PE spectrum of $[\text{Au}_{38}(\text{SC}_2\text{H}_4\text{Ph})_{24}]^-$, generated by the MALDI process from neutral $[\text{Au}_{38}(\text{SC}_2\text{H}_4\text{Ph})_{24}]^0$, will also be presented.

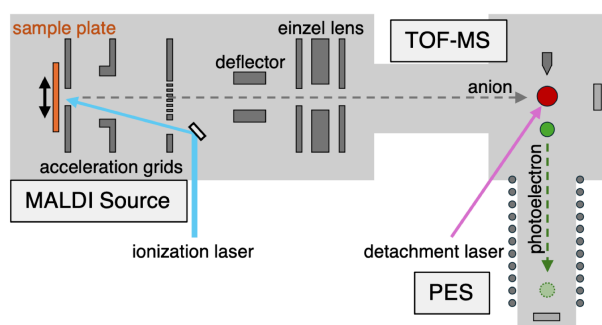


Figure 1. Schematic view of the MALDI-PES.

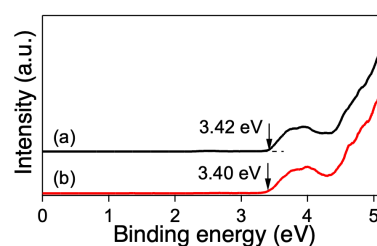


Figure 2. PE spectra of $[\text{Au}_{25}(\text{SC}_2\text{H}_4\text{Ph})_{18}]^-$ generated by (a) ESI and (b) MALDI.

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