

Single particle inductively coupled plasma mass spectrometry imaging of immunochemically labeled spheroid sections

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Spheroids are one of the 3D biological models whose arrangement of proliferating and necrotic cells resembles the tumor microenvironment. One of the markers of proliferation is Ki-67 protein, which is expressed by cells in the active phase of the cell cycle. Immunohistochemical labeling with a primary antibody and a fluorophore-labeled secondary antibody followed by fluorescence microscopy analysis is commonly used for two- and three-dimensional imaging of the target protein in spheroid sections.

We have successfully switched from fluorophore labeling of KI-67 to nanoparticle labeling combined with LA ICP MS. Recently, gold nanoparticles were used as very sensitive immunochemical tags in conventional UV laser ablation ICP MSI.¹ In our approach 20-nm gold nanoparticles tags were desorbed from the spheroid section with 2940 nm laser ablation system. In comparison to UV, IR laser allows tissue ablation and desorption of intact nanoparticle tags, allowing their precise counting leading to high sensitivity. Finally, our technique is compared to mainstream imaging techniques such as confocal fluorescence microscopy or UV LA ICP MS.

Keywords: imaging, nanoparticle, single particle, SP ICP MS, LA ICP MS, laser ablation

1. Tvrdonova, M., Vlcnovska, M., Vanickova, L.P. *et al.* Gold nanoparticles as labels for immunochemical analysis using laser ablation inductively coupled plasma mass spectrometry. *Anal Bioanal Chem* **411**, 559–564 (2019).

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