

Raman Spectroscopy Group



HEAD:

Prof. Andrzej Kudelski*, PhD DSc

GROUP MEMBERS:

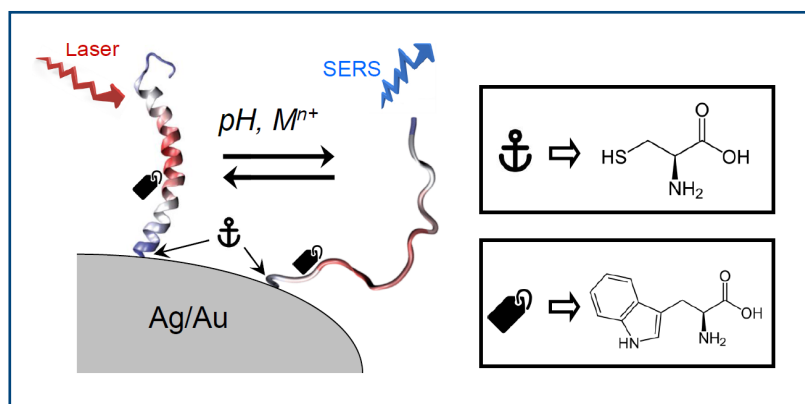
Aleksandra Jaworska, PhD; Jan Krajczewski, PhD;
Agata Królikowska, PhD; Beata Wrzosek, PhD
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RESEARCH PROFILE:

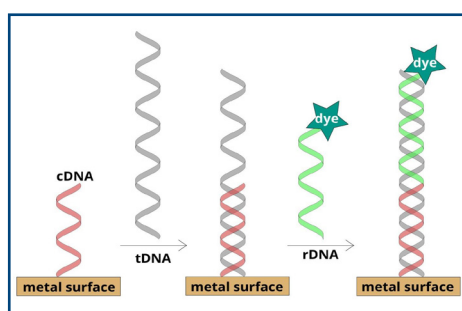
Our research focuses on various applications of Raman spectroscopy, especially surface-enhanced Raman scattering (SERS).

CURRENT RESEARCH ACTIVITIES:

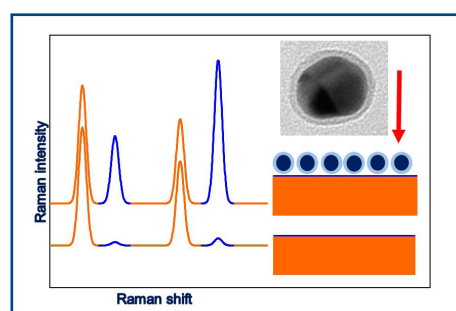
- Hybrid nanostructures combining plasmonic and magnetic properties and their application for SERS detection and recovery/removal of the target analyte.
- SERS blinking on anisotropic silver nanoparticles.
- Theoretical modelling of vibrational spectra.
- Synthesis of system for controlled transport of biomolecules. Fabrication of SERS substrates with limited areas of appropriately selected monolayers and developing conditions for the control of their properties, and in consequence – monolayer structures, enabling efficient transport of adsorbed biomolecules over the entire SERS substrate.
- SERS studies of oligopeptides containing cysteine and tryptophan adsorbed on Ag and Au as models for biomolecular receptors with external stimuli-responsive conformations.
- In situ multi-spectroscopic molecular characterisation of DNA films on metal surfaces in aqueous environment.
- Application of SERS for detection of BRAF mutation in melanoma.
- Analysis of surfaces of various materials (especially in situ) using shell-isolated nanoparticle-enhanced Raman spectroscopy (SHINERS).



Scheme showing the idea of a SERS-based sensor, exploiting a protein-derived peptide fragment anchored to metal by Cys residue and labeled with Trp, responding with a conformational transition to external stimuli (e.g. pH or biologically relevant metal cation concentration).



The principles of detecting of DNA using SERS spectroscopy.



The principles of SHINERS measurements.

SELECTED PUBLICATIONS:

1. A. Królikowska, J. Cukras, M. Witkowski, D. Tymecka, A. Hernik-Magoń, A. Misicka, W. Dzwolak, SERS and DFT Study of Noble-Metal-Anchored Cys-Trp/Trp-Cys Dipeptides: Influence of Main-Chain Direction and Terminal Modifications, *J. Phys. Chem. C* 124 (2020) 7097–7116.
2. E. Pyrak, A. Jaworska, A. Kudelski, SERS studies of adsorption on gold surfaces of mononucleotides with attached hexanethiol moiety: Comparison with selected single-stranded thiolated DNA fragments, *Molecules* 24 (2019) 3921-1–3921-18.
3. A. Kowalczyk, J. Krajczewski, A. Kowalik, J.L. Weyher, I. Dziecielewski, M. Chłopek, S. Gózdź, A.M. Nowicka, A. Kudelski, New strategy for the gene mutation identification using surface enhanced Raman spectroscopy (SERS), *Biosens. Bioelectron.* 132 (2019) 326–331.
4. B. Wrzosek, J. Cukras, M. Dobrowolski, J. Bukowska, The real chemical states of 3-sulphur derivative of 1,2,4-triazole in different conditions – complex experimental and theoretical studies, *J. Phys. Chem. C* 121 (2017) 9282–9295.
5. K. Kołatąj, J. Krajczewski, A. Kudelski, Silver nanoparticles with many sharp apexes and edges as efficient nanoresonators for shell-isolated nanoparticle-enhanced Raman spectroscopy, *J. Phys. Chem. C* 121 (2017) 12383–12391.
6. J. Krajczewski, K. Kołatąj, A. Kudelski, Plasmonic nanoparticles in chemical analysis, *RSC Adv* 7 (2017) 17559–17576.
7. H.B. Abdulrahman, J. Krajczewski, D. Aleksandrowska, A. Kudelski, Silica-protected hollow silver and gold nanoparticles: new material for Raman analysis of surfaces, *J. Phys. Chem. C* 119 (2015) 20030–20038.
8. P. Piotrowski, B. Wrzosek, A. Królikowska, J. Bukowska, SERS-based pH sensor utilizing 3-amino-5-mercapto-1,2,4-triazole functionalized Ag nanoparticles, *Analyst* 139 (2014) 1101–1111.
9. A. Królikowska, Surface-enhanced resonance Raman scattering (SERRS) as a tool for the studies of electron transfer proteins attached to biomimetic surfaces: Case of cytochrome c, *Electrochim. Acta* 111 (2013) 952–995.
10. R. Solarz, A. Królikowska, J. Augustyński, Silver nanoparticles-induced photocurrent enhancement at WO₃ photoanodes, *Angew. Chem. Int. Ed.* 49 (2010) 7980–7983.