Macromolecular diffusion dynamics in shear flow studied with MIET

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Metal induced energy transfer (MIET) has been utilised to localise fluorescent emitters axially with nanometre accuracy.[1, 2] The technique relies on the quenching of the excited-state fluorescence lifetime of a fluorophore which is caused by energy transfer to a thin conducting metal film. Therefore, the effect scales with the distance of the fluorophore to the metal surface. In addition to the lifetime, the fluorescence intensity is modulated which allows the observation of fluctuations of the fluorophore-surface distance through the fluctuations in intensity. Intensity correlation enables us to study molecular dynamics with MIET (dynaMIET). The fabrication of a micro fluidic device on a gold coated and silanised glass surface provides a tool to specifically bind fluorescently end-labelled DNA to the surface and to study the diffusion dynamics of the DNA under a defined shear force. With an increased shear rate, we observe a reduction in lifetime. This experiment additionally shines light on the time-scale of the vertical diffusion by analysis of the intensity correlation.

[1] Karedla, N., Chizhik, A. I., Gregor, I., Chizhik, A. M., Schulz, O., & Enderlein, J. (2014). "Single-Molecule Metal-Induced Energy Transfer (smMIET): Resolving Nanometer Distances at the Single-Molecule Level." *ChemPhysChem*, *15*(4), 705–711. https://doi.org/10.1002/cphc.201300760

[2] Isbaner, S., Karedla, N., Kaminska, I., Ruhlandt, D., Raab, M., Bohlen, J., Chizhik, A., Gregor, I., Tinnefeld, P., Enderlein, J., Tsukanov, R. (2018). "Axial Colocalization of Single Molecules with Nanometer Accuracy Using Metal-Induced Energy Transfer." *Nano Letters*, *18*(4), 2616–2622. https://doi.org/10.1021/acs.nanolett.8b0042