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ESR7



MSc in Applied Physics
GIK, Pakistan



Photoanode annealing effects on the charge transport properties of dye sensitized solar cell

W.Pervez, JMS: Materials in electronics, 31(1) 779-784 (2020)

Technical Assistant
IFPAN, Poland



Strain and lattice vibration mechanisms in GaN -Al_xGa_{1-x}N nanowires structures on Si substrate

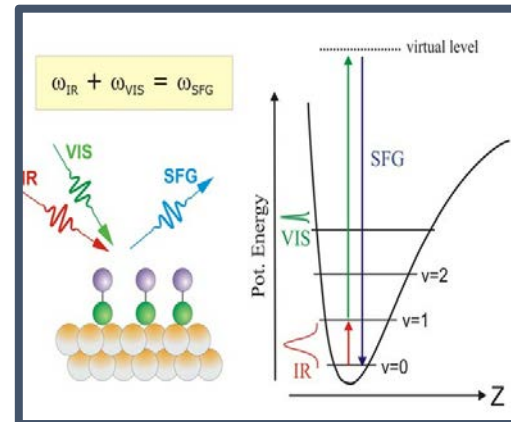
W.Pervez, Applied Surface Science 588, 151901 (2022)

PhD project: Vibrational SFG as Diagnostic for Reactive Adsorption

Study the surface chemistry of clusters deposited on surfaces

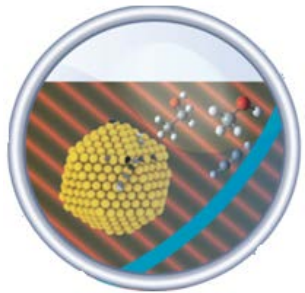
Surface characterization

- LEED, RHEED etc
- Scanning probe (STM, AFM etc)
- X-ray, IR and Raman spectroscopy
- **Vibrational sum-frequency generation**



Vibrational SFG spectroscopy

- ❖ Non-linear optical process combining two optical fields: IR and visible
- ❖ Strong enhancement when in resonance with vibrational transition
→ Structure-sensitive
- ❖ Selection rule: requires non-symmetric medium
→ Surface specific: probes only molecules on the surface

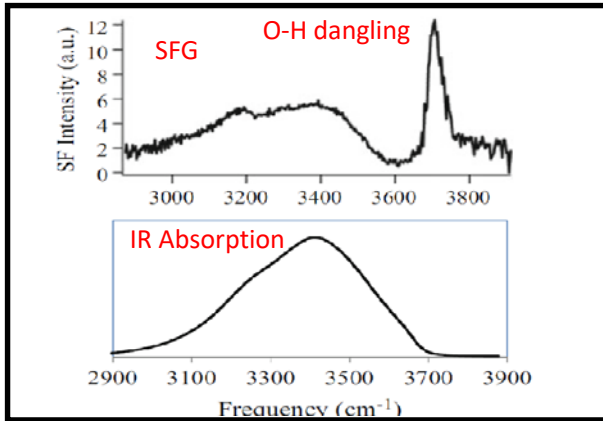


FELIX

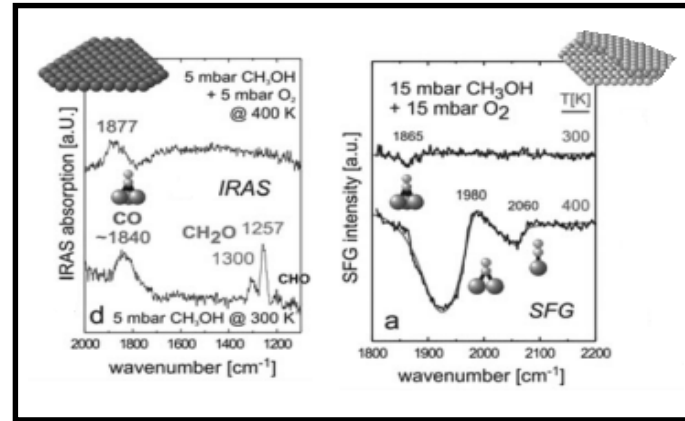
The Netherlands



Surface specificity

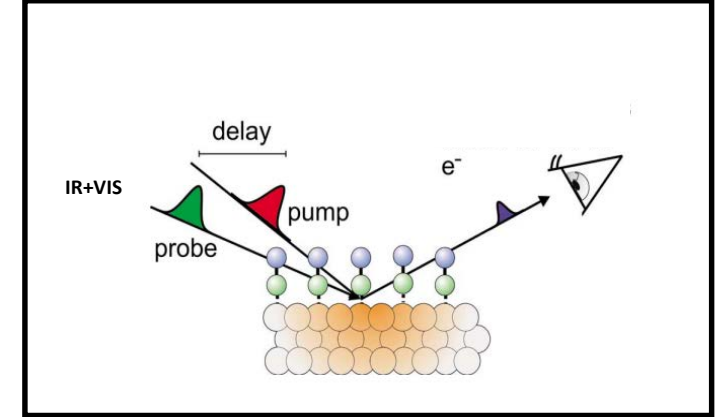


Morita, *A Theory of SFG Spectroscopy* (2018)



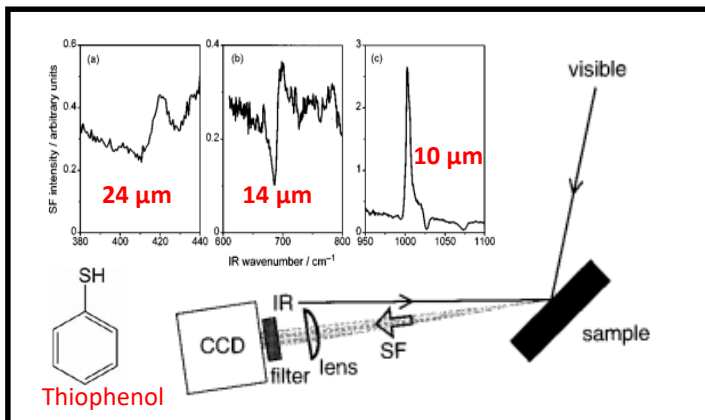
Joachim, *Phys. Chem. Chem. Phys.* **9**, 3541 (2007)

Potential for pump-probe



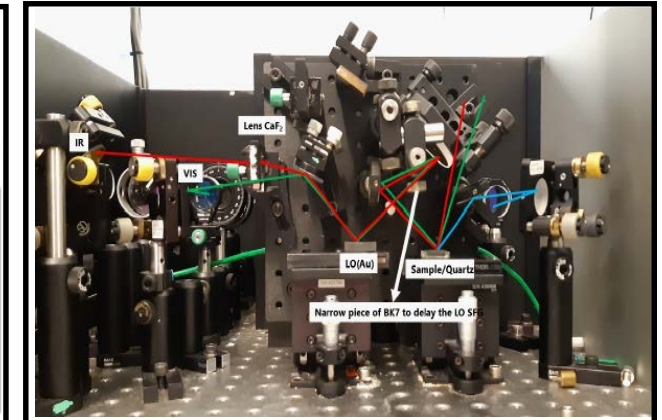
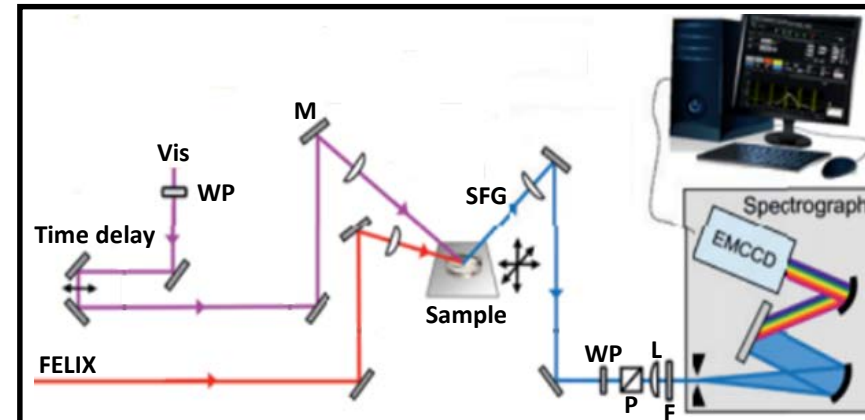
Bonn, *Surf. Sci.* **500**, 475 (2002)

Far-IR SFG with FELIX



Braun, *J. Chem. Phys.* **110**, 4634 (1999)

My planned implementation



Similar setup, Huib Bakker, AMOLF, Amsterdam

Plan of work

- Setup design and assembly
- Secondment at KU Leuven

Cluster deposition $Cu_n@Ag$, $Cu_n@carbon$

Characterization non-linear optical properties doped Au clusters

Feb-March 2022

- Start SFG experiment at FELIX

Validate setup using GaP, ZnSe, Thiophenol@Ag/Si

Extend to far-IR using samples made @KUL

June

fall/winter

- Secondment at U Antwerp

TEM characterization of samples made @KUL

Oct-Dec 2022

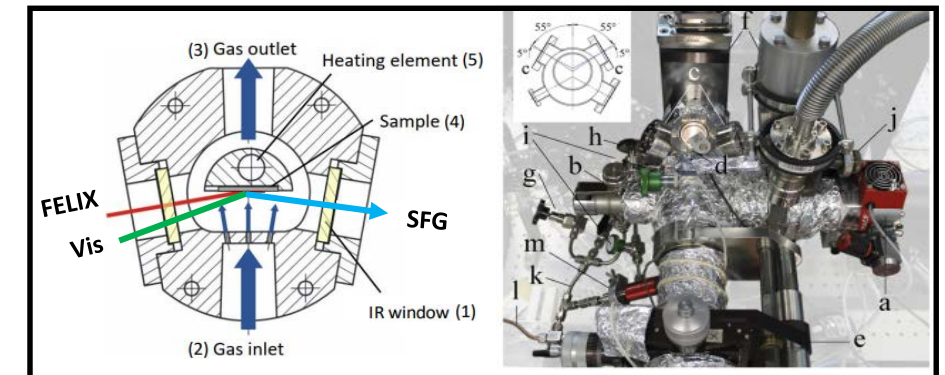
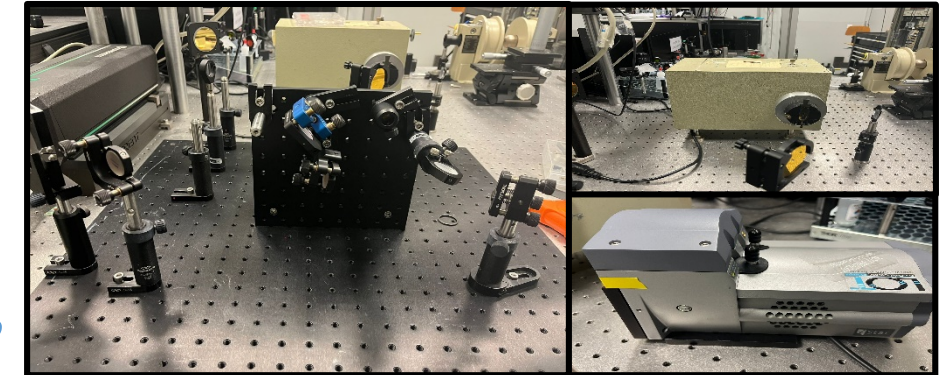
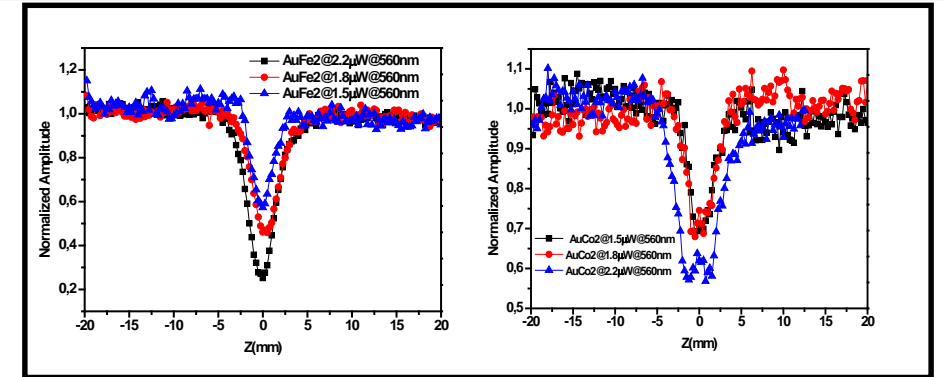
- Implement SFG for reactions

high pressure cell and/or UHV system

allow dosing of CO₂ and H₂

study CO₂ hydrogenation

2023-24



PSI design, Sumant Phadke

Rupprechter, APL(2018)

Further training

Conference contributions

- Nijmegen symposium (Institute for Molecules & Materials)
- National Physics conference
- Local seminars (Leuven, Nijmegen)



Scientific

- Catlab online course from Cardiff University



Skills

- Wrote FELIX beam time proposal
- Social dutch course
- Pitch course



Radboud **in'to** Languages
experts in language and communication

