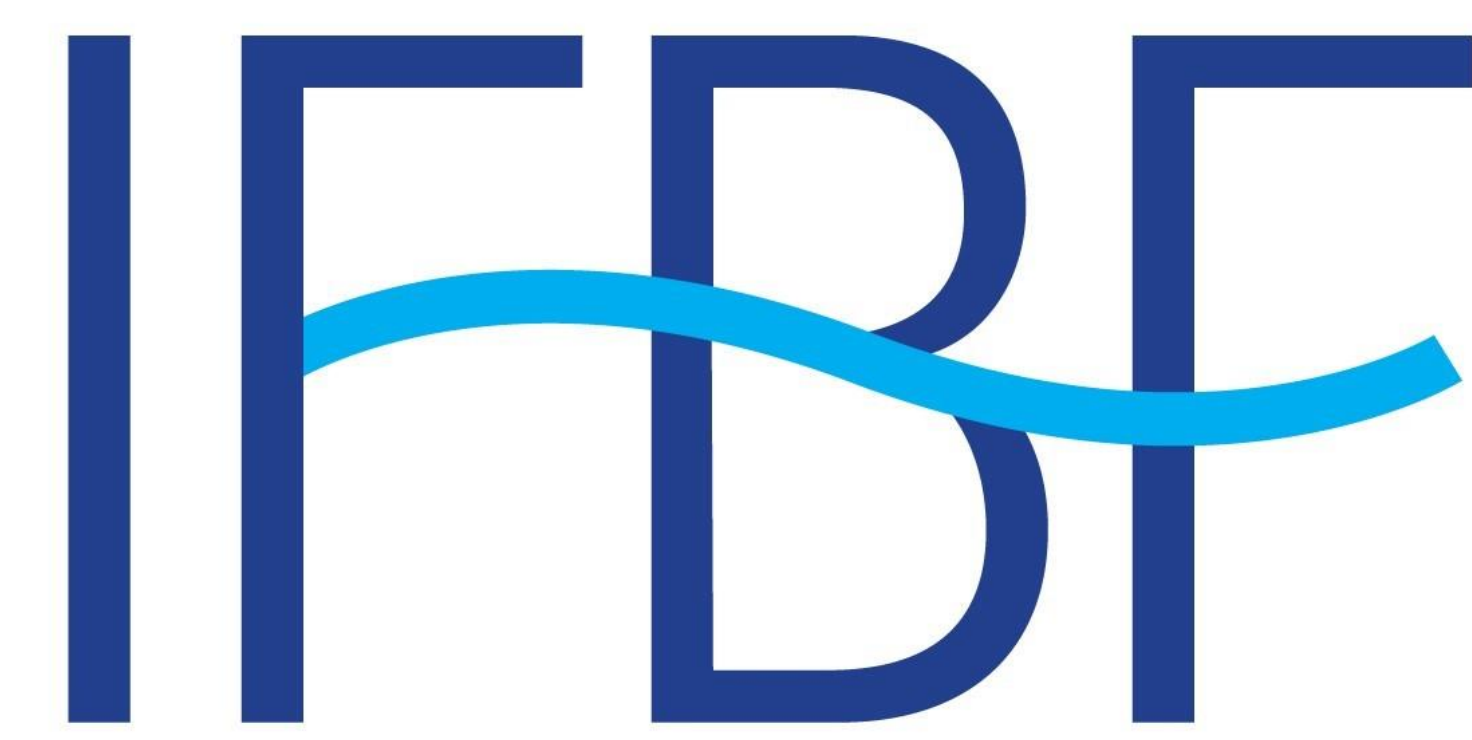


Quantifying vanadium electrolytes via UV-visible spectroscopy: Calibration Methods and Open Access Spectral Database.

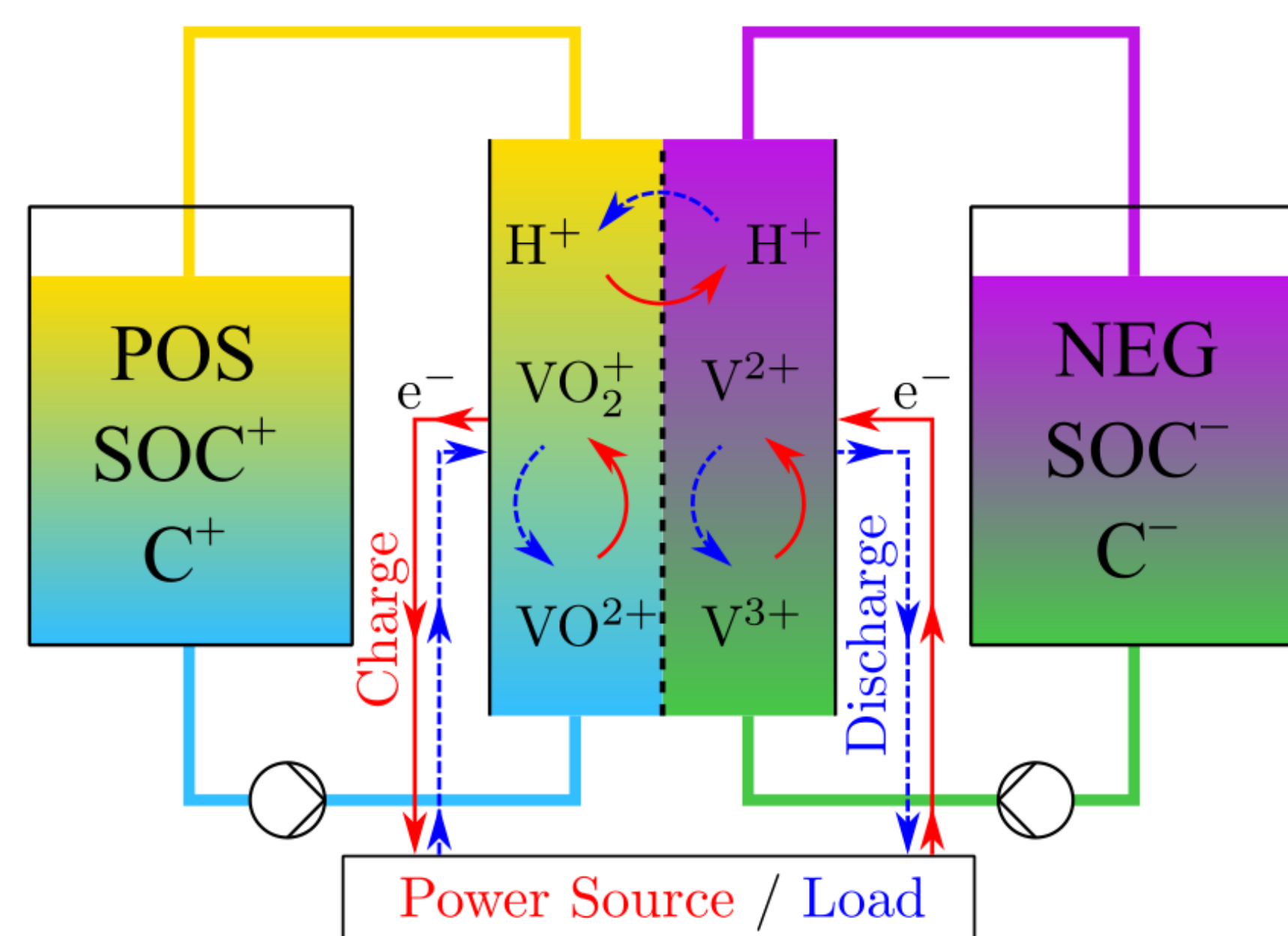


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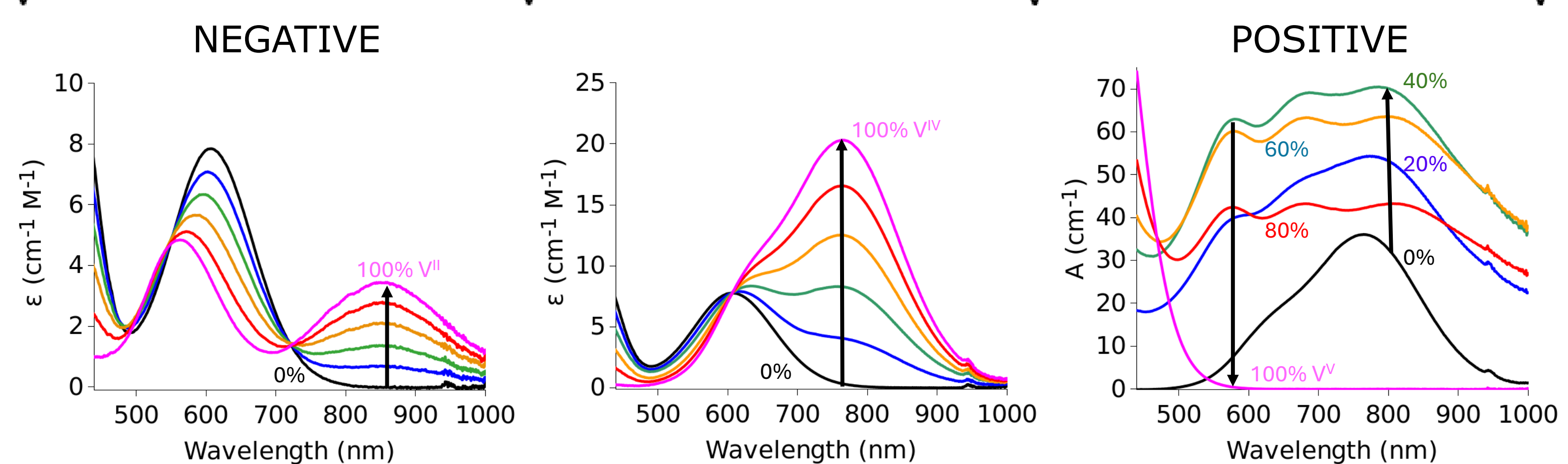
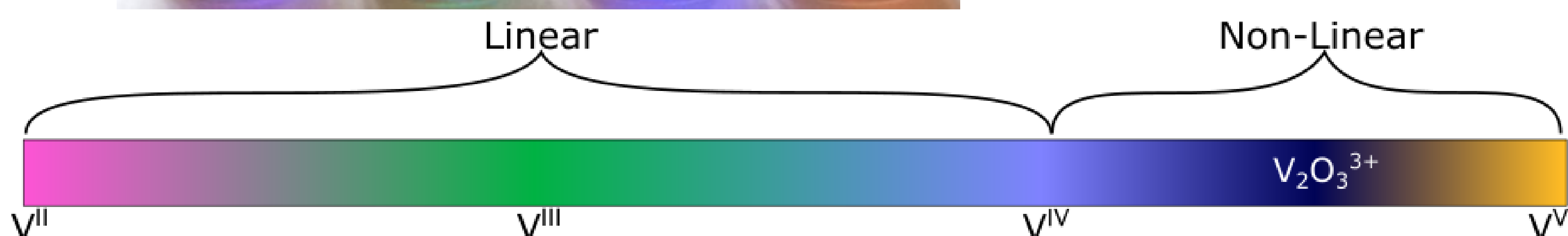
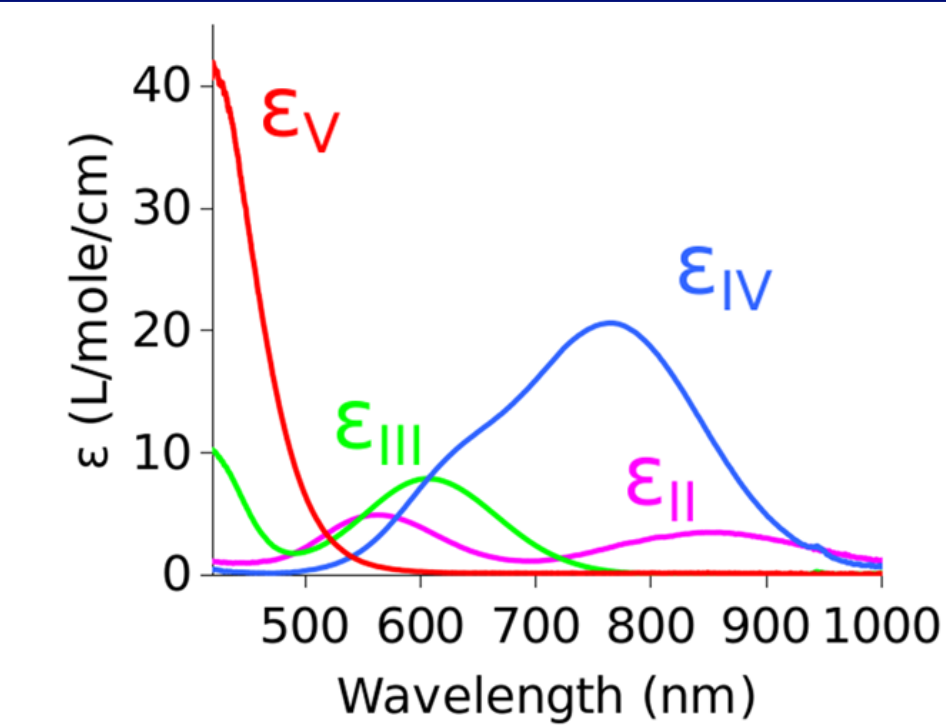
² R&D Department, Micro Electrochemical Technologies, Leganés, 28918, Madrid, Spain

Vanadium Redox Flow Batteries

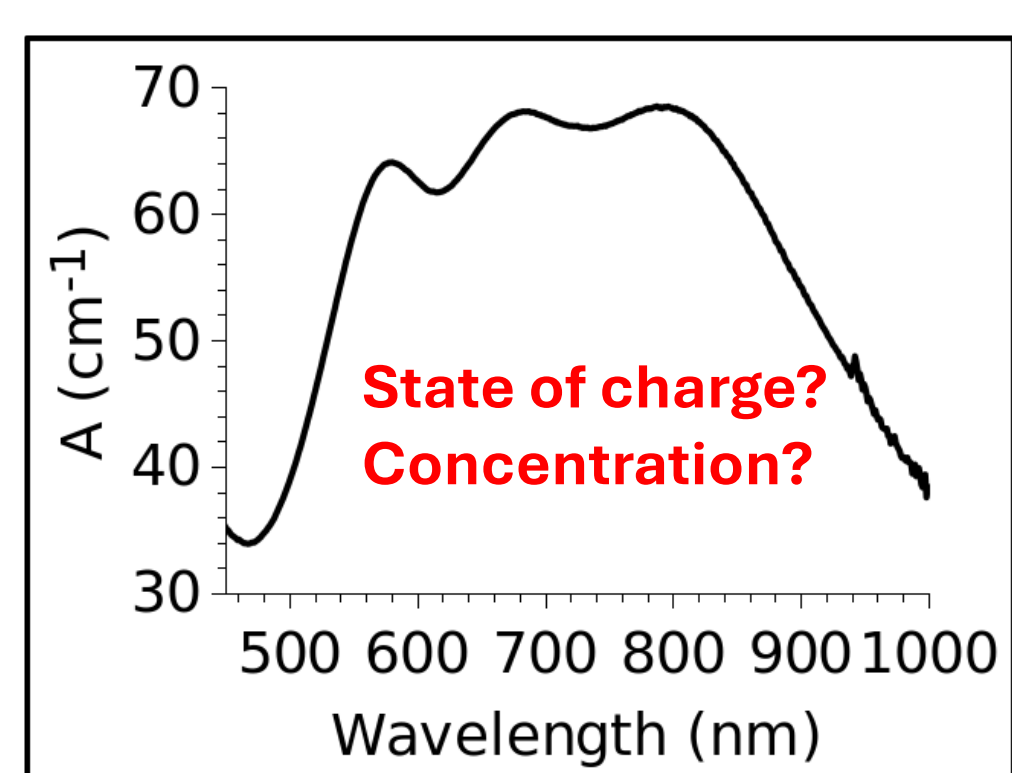


- Promising energy storage solution
- High cycling endurance
- BUT**
- Over time $SOC^+ \neq SOC^-$ and $C^+ \neq C^-$
MONITORING?

UV/Visible Spectroscopy of Vanadium Electrolytes



Calibration

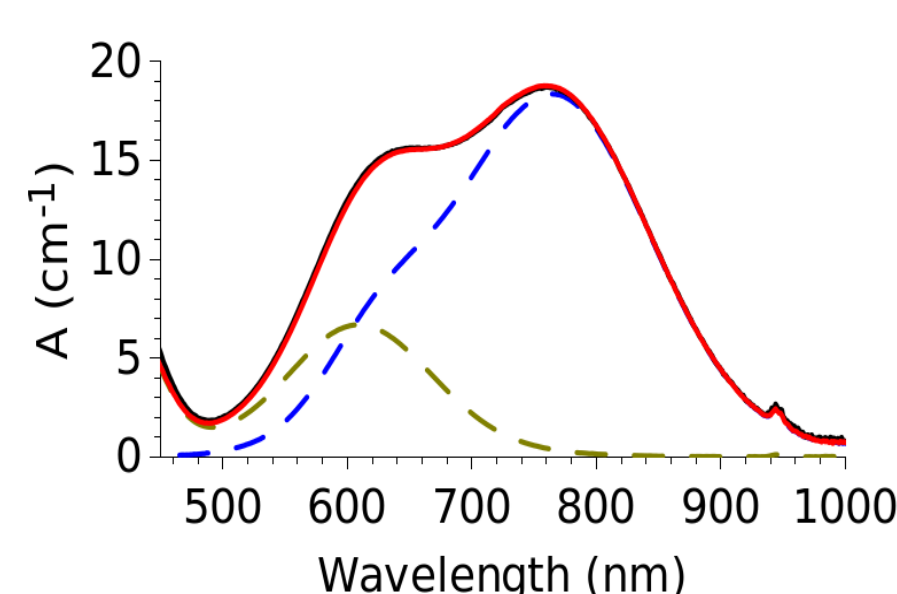
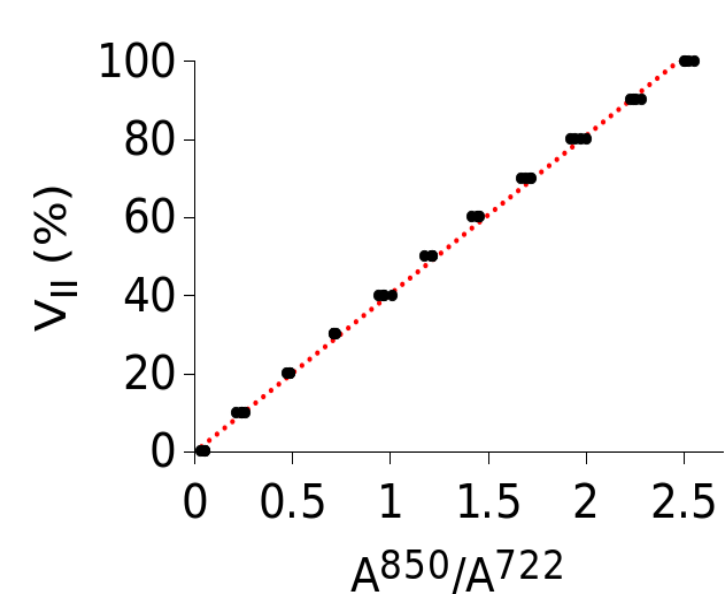


Empirical

« Fast »

Deconvolution

« Accurate »



- Uses only two values
- Less precise
- Industrial applications**
- Uses the full spectrum
- Highly accurate
- Laboratory applications**

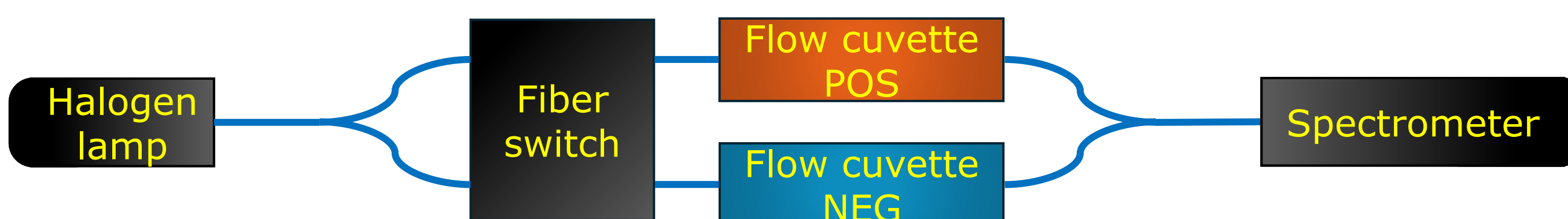
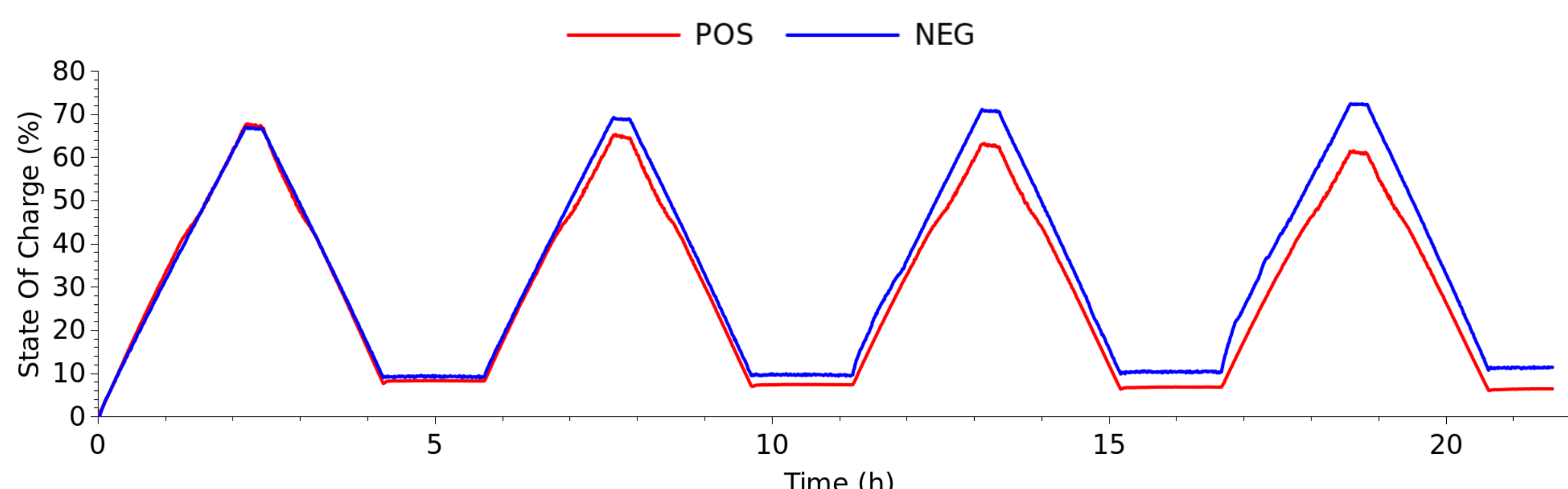
Total concentration

State of Charge

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- FEDER/MICINN- Agencia Estatal de Investigación TED2021-129378B-C21 and PID2019106740RB-I00/AEI/10.13039/501100011033.
- MCSF-Cofund "Energy for Future" (E4F) postdoctoral research fellowship by the Spanish Iberdrola Foundation (GA-101034297).

In-Operando Dual Measurements



Open Access Database

- C = 0.9-1.8 M
- 3 vanadium mixtures
- 132 spectra
- 6 Calibration algorithms

Source code & Spectral Data



https://github.com/AngeAM/SOC_Vanadium_Spectra_2023.git

Publication



10.1016/j.electacta.2024.144003

Conclusions

- Complete spectroscopy database
- Wide concentration range
- Gives both concentration and state of charge
- Covers all vanadium electrolytes VII/VIII, VIII/IV, IV/V
- Precision:
 - 1-1.5% for
 - 25-35mM for C