INTERFACIAL MOLECULAR-SCALE INVESTIGATIONS OF METAL ADSORPTION ONTO GRAPHENE-BASED TWO-DIMENSIONAL MATERIALS

Fundamental studies of graphene-water interfaces

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MOTIVATION
- Filtration of heavy metal ions from water resources offers one possible solution for remediation.
- Graphene is an attractive material due to its unique 2D properties and mechanical robustness
- Advances in filtration technologies require systematic, fundamental surface-specific studies of metal adsorption and ion selectivity in different relevant conditions, as interfacial and surface interactions greatly differ from those of the bulk
- In situ interfacial techniques, such as crystal truncation rod and resonant anomalous x-ray reflectivity, can reveal direct, molecular-level, and element-specific information about ion-surface interactions

EXPERIMENTAL SETUP
- Custom electrochemical transmission cell mounts to standard goniometer, compatible with crystal truncation rod setup
- Connected potentiostat applies a controlled potential across graphene sample
- Can inject different solutions without disassembling
- Allows in situ crystal truncation and resonant anomalous x-ray reflectivity measurements

RESULTS: CRYSTAL TRUNCATION ROD
- Reflectivity data are fitted to model including substrate SiC and layered water features
- Yttrium ions adsorb to graphene surface
- Water layers also change slightly

REFERENCES
- https://www.graphene-info.com/researchers-develop-enhanced-graphene-sieve-could-advance-clean-water-efforts

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CRystal truncation rod and resonant anomalous x-ray reflectivity
- Crystal truncation rod reflectivity: x-ray scattering technique measured over the linear inverse q-space perpendicular to the surface, i.e. rods, that reveals surface atomic structure information
- Resonant anomalous x-ray reflectivity: resonant x-ray scattering technique measured over energies near relevant adsorption edge at specific q-values that reveals elemental-specific structure information

REFERENCES
- https://www.graphene-info.com/researchers-develop-enhanced-graphene-sieve-could-advance-clean-water-efforts
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