

Selective Deposition of Pd onto Silica Supported Iron for Maintaining Fe⁰ during Hydrodeoxygenation

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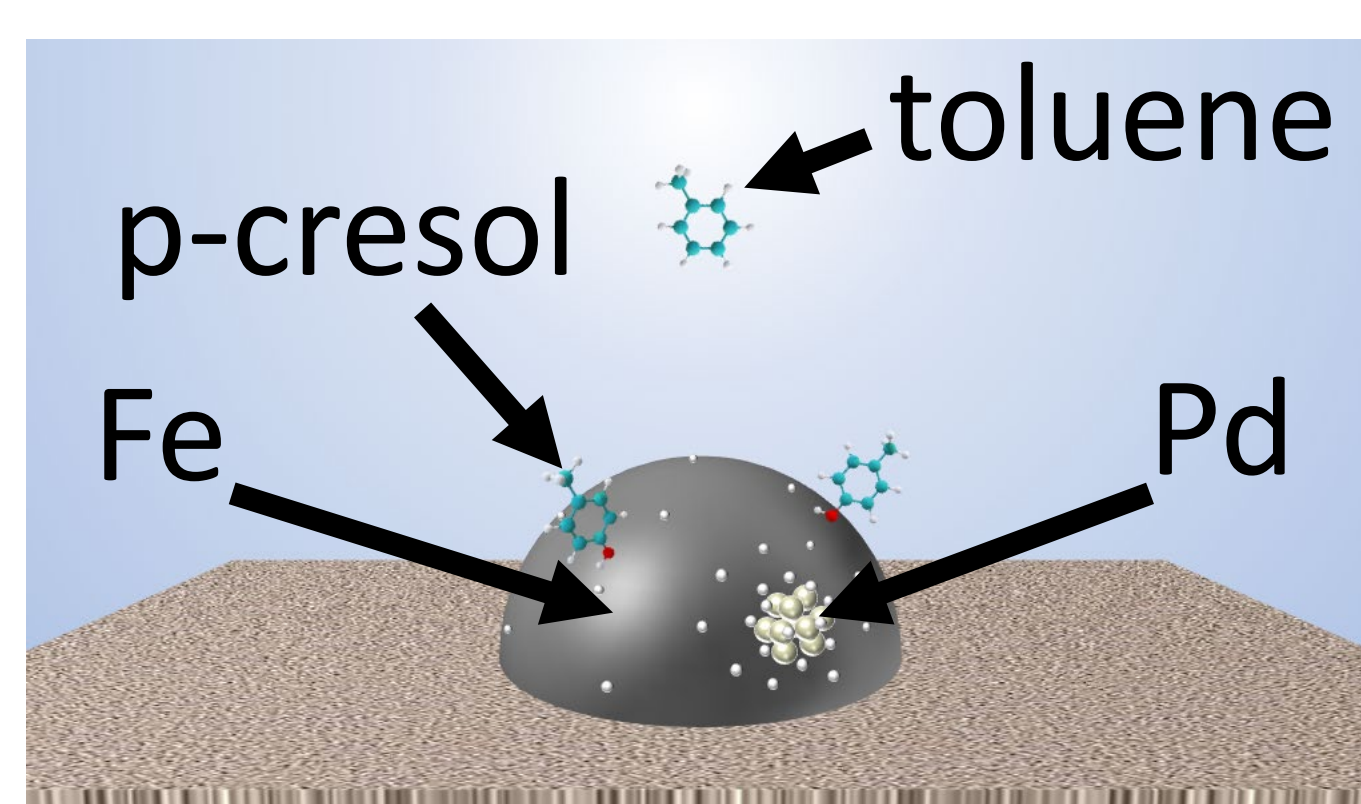
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Purpose:
Wood to gasoline

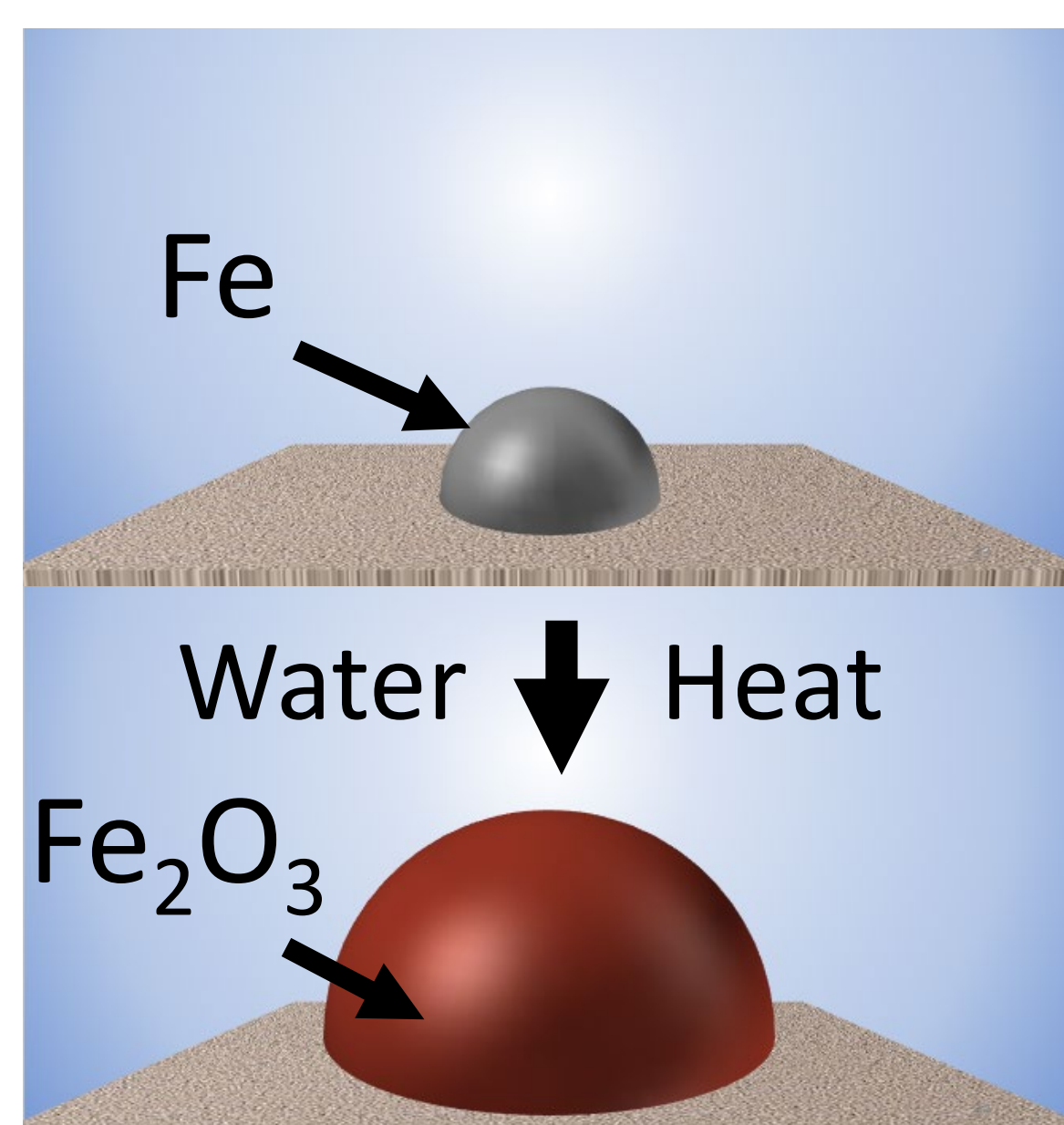


Introduction:

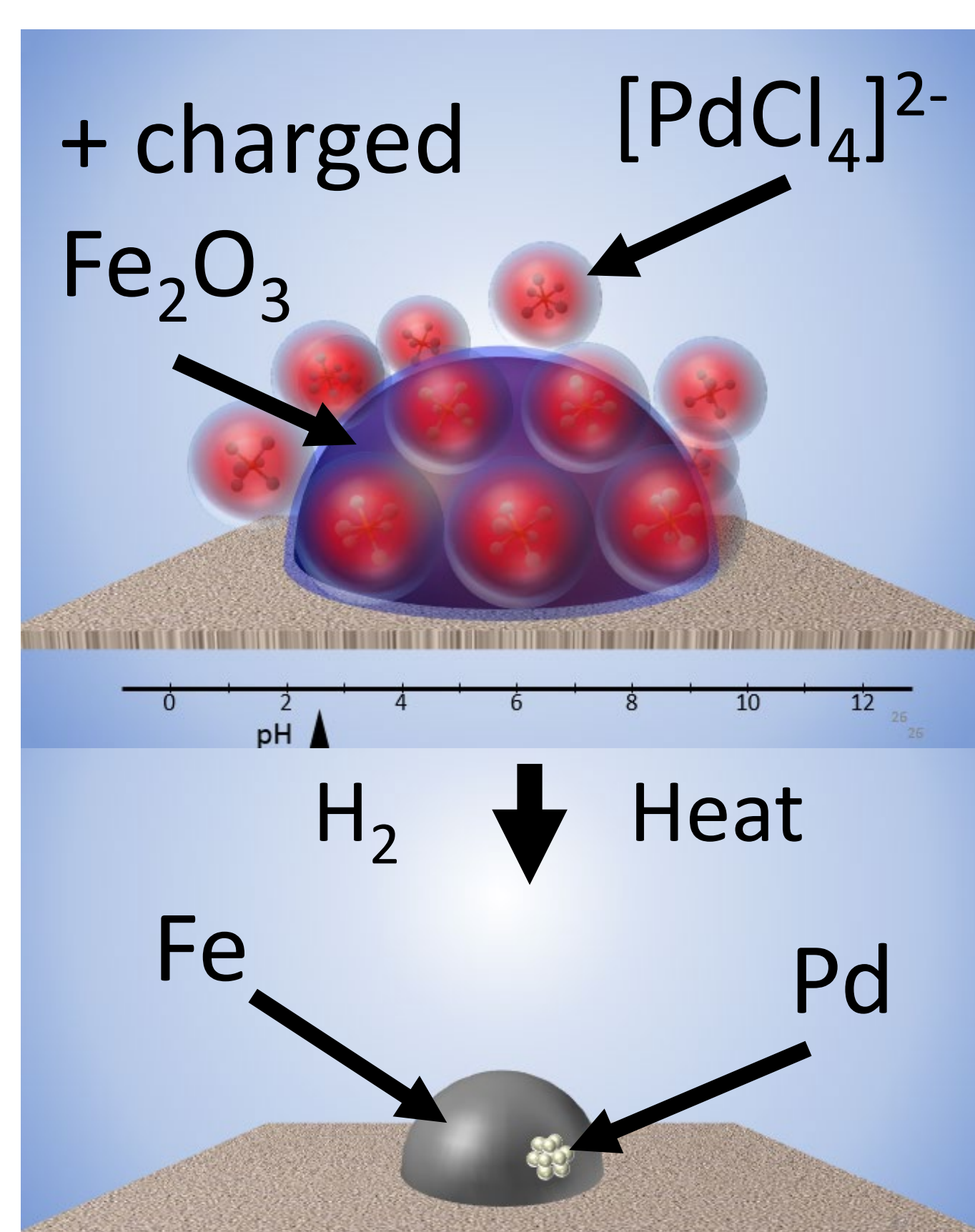
- Pd helps dissociate H₂; Fe⁰ is the active site for deoxygenation¹



- The main cause of Fe⁰ deactivation is oxidation by water²



- Pd helps protect Fe⁰ sites from water oxidation^{2,3}
- Pd can be selectively steered with Strong Electrostatic Adsorption (SEA)^{4,5}

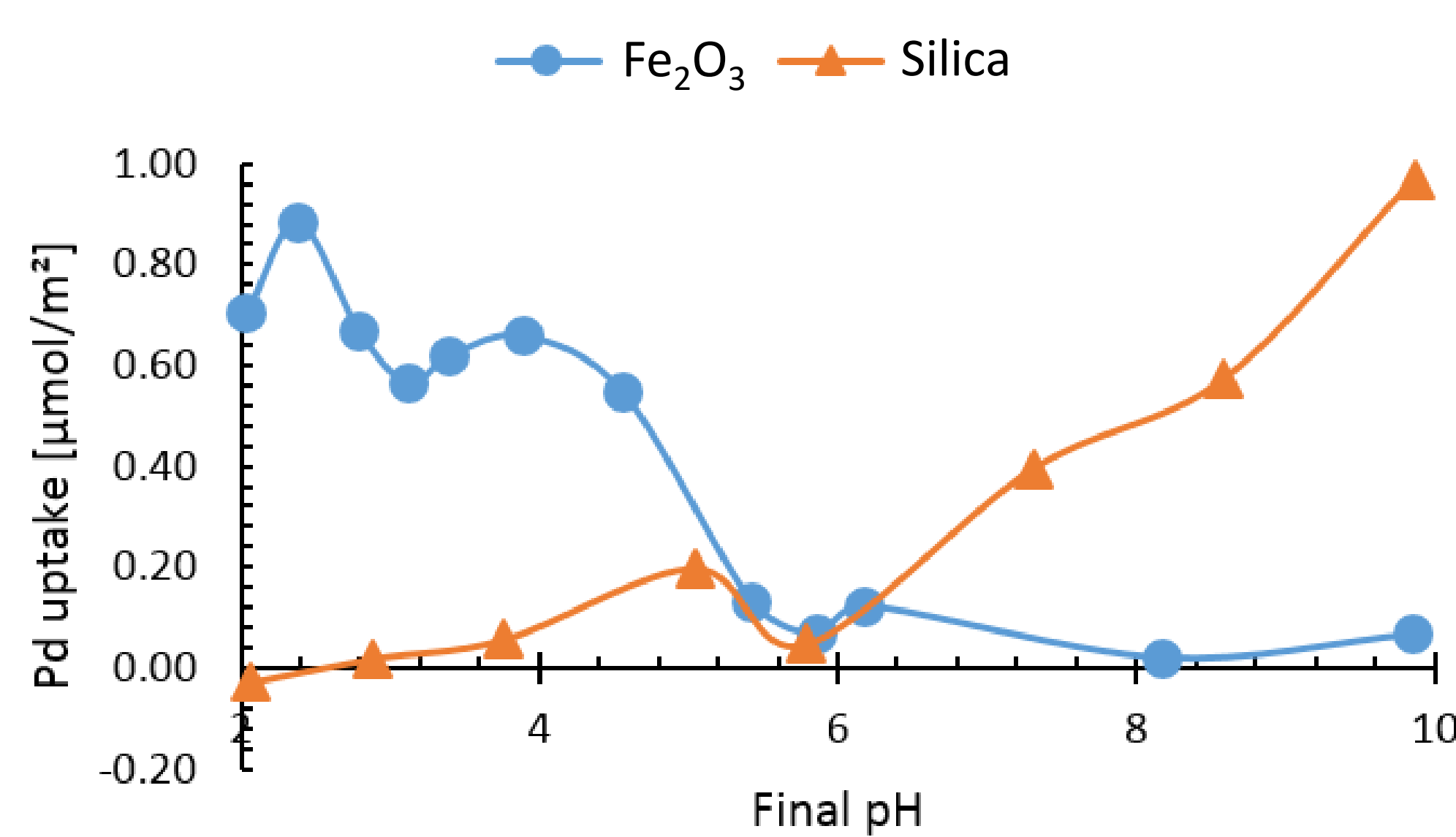


Hypothesis

Pd can be steered onto Fe₂O₃ for improved Fe reducibility

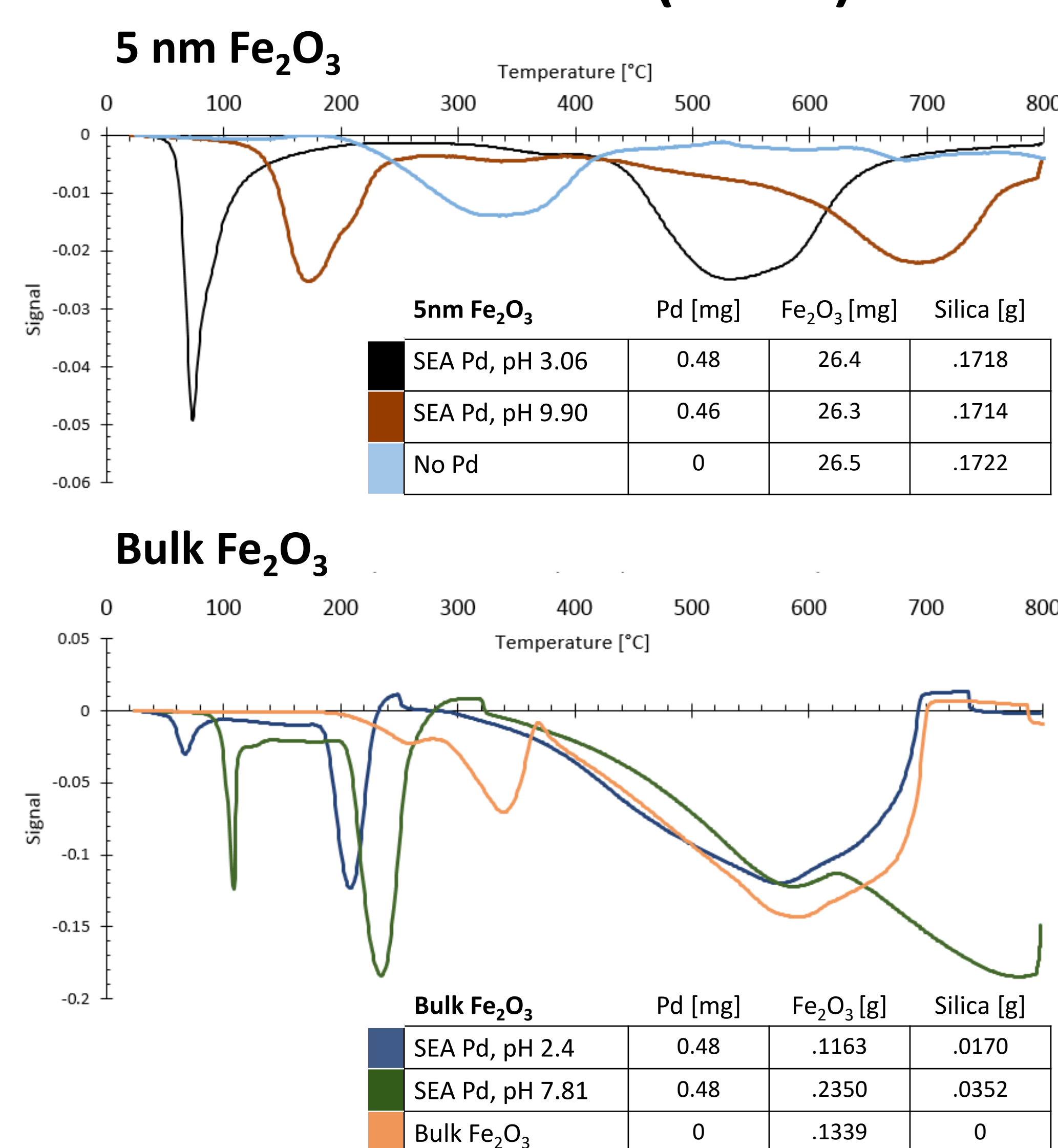
Uptake Surveys

PdCl₄/amine complex uptake over Fe₂O₃ and silica



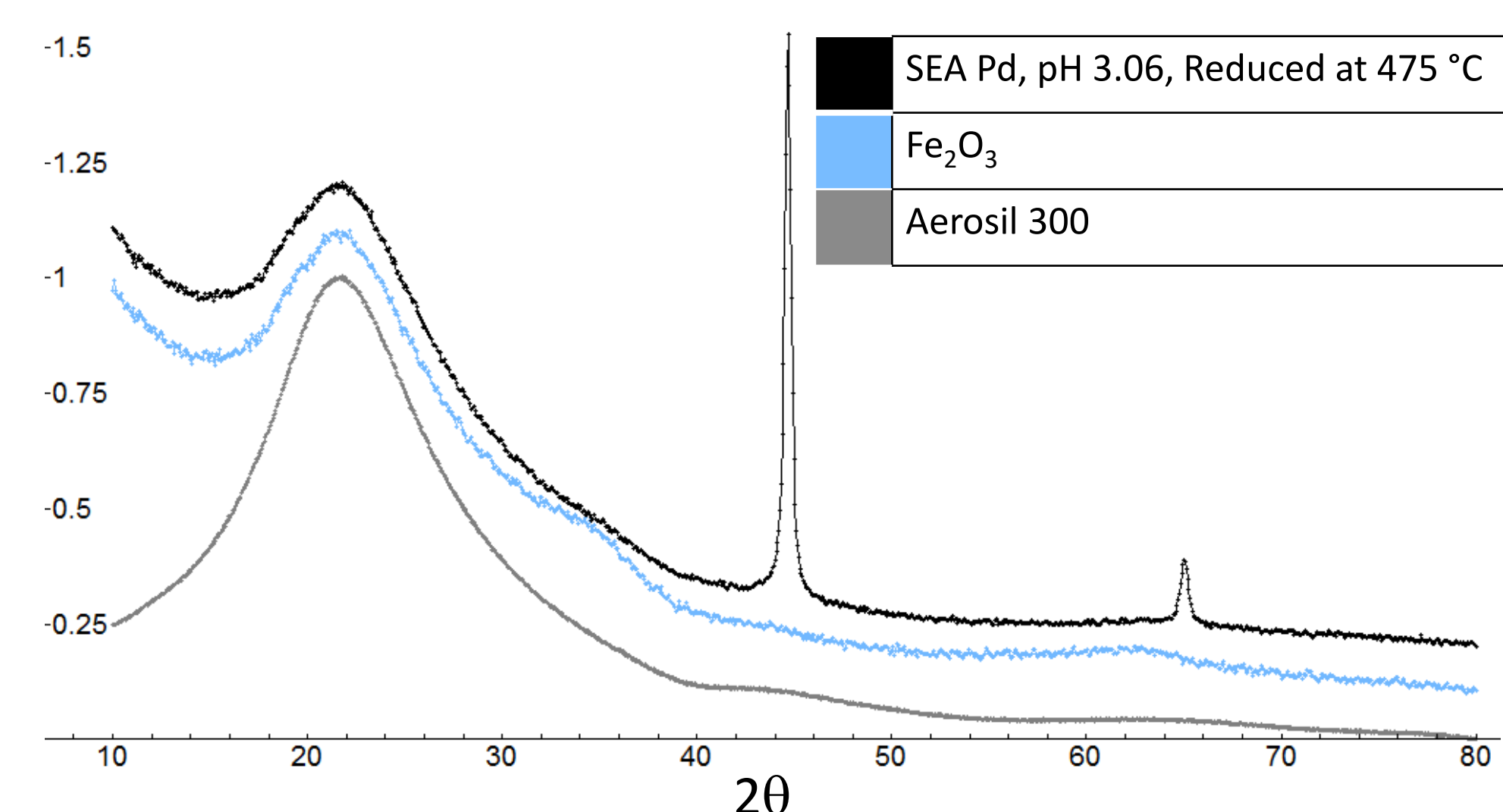
- At low pH, Pd adsorbs on Fe₂O₃
- At high pH, Pd adsorbs on silica

Temperature Programmed Reduction (TPR)



- Pd adsorbed at high pH shows some enhanced reducibility – suggests H₂ spillover
- Pd adsorbed at low pH shows most reducibility – indicates an electronic effect
- Bulk Fe₂O₃ TPRs indicate the electronic effect has limited range, said to be 4 Angstroms³

X-Ray Diffraction (XRD)



- Fe₂O₃ before reduction shows mostly 5nm γ-Fe₂O₃
- Pd/Fe₂O₃ reduced at 475 °C shows large Fe⁰ peaks – avg. particle size is 40 nm

Conclusions

- Pd can be steered onto Fe₂O₃ using SEA
- These samples show enhanced reducibility
- Reactivity testing underway soon
- Future efforts to reduce the Fe particle size

References

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Acknowledgments



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