

Bench-Scale SCR Catalyst Testing for Long-Term Management and Troubleshooting

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PRIMARY TOPICS

- **Catalyst Theory**
- **Bench-scale apparatus and data analysis**
- **Catalyst Management**
- **Troubleshooting**
- **Research Capabilities**
- **Conclusions**

Theory - Diffusion and Reaction Rates

Bulk Flow →

External Diffusion

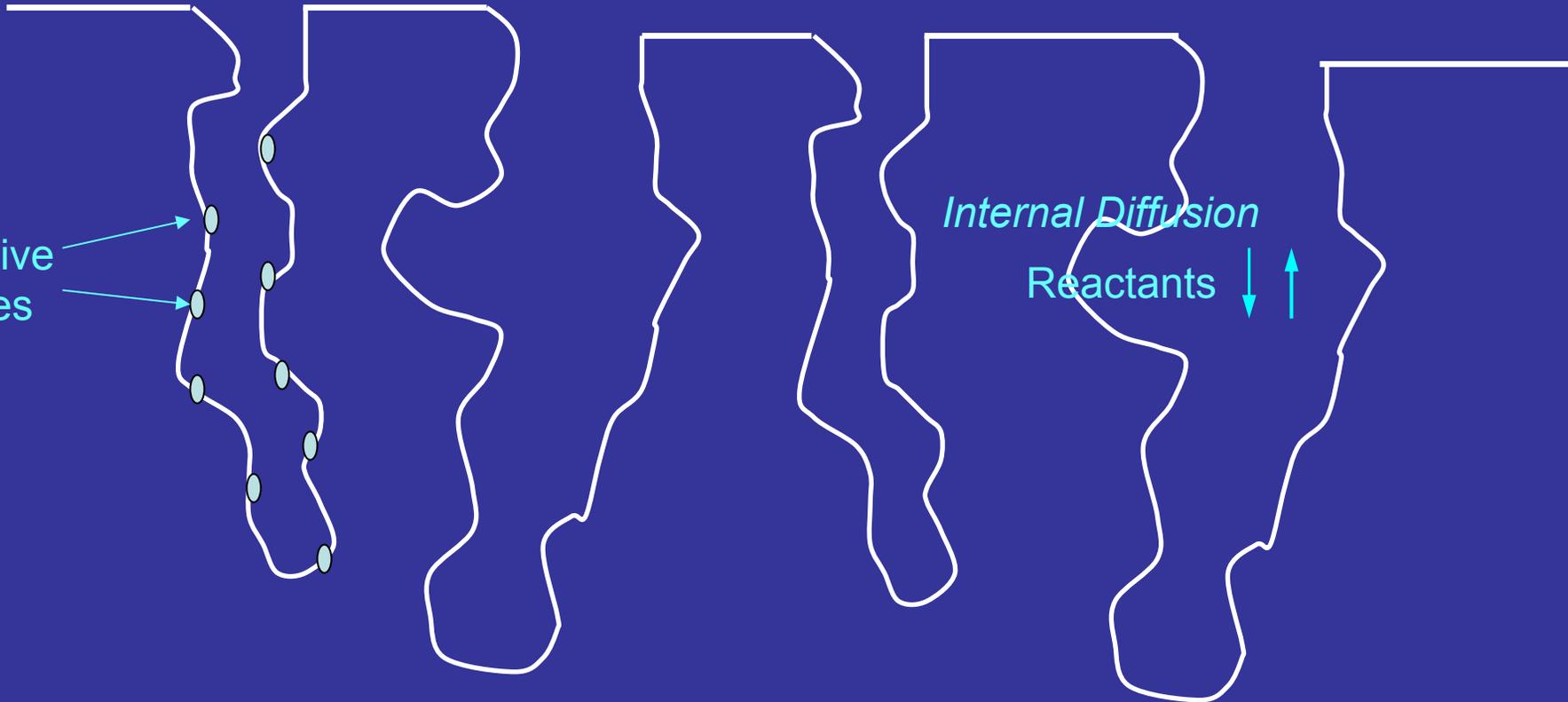
Reactants ↓ ↑

Boundary Layer ≡≡≡

Active Sites →

Internal Diffusion

Reactants ↓ ↑



REACTION SPEED

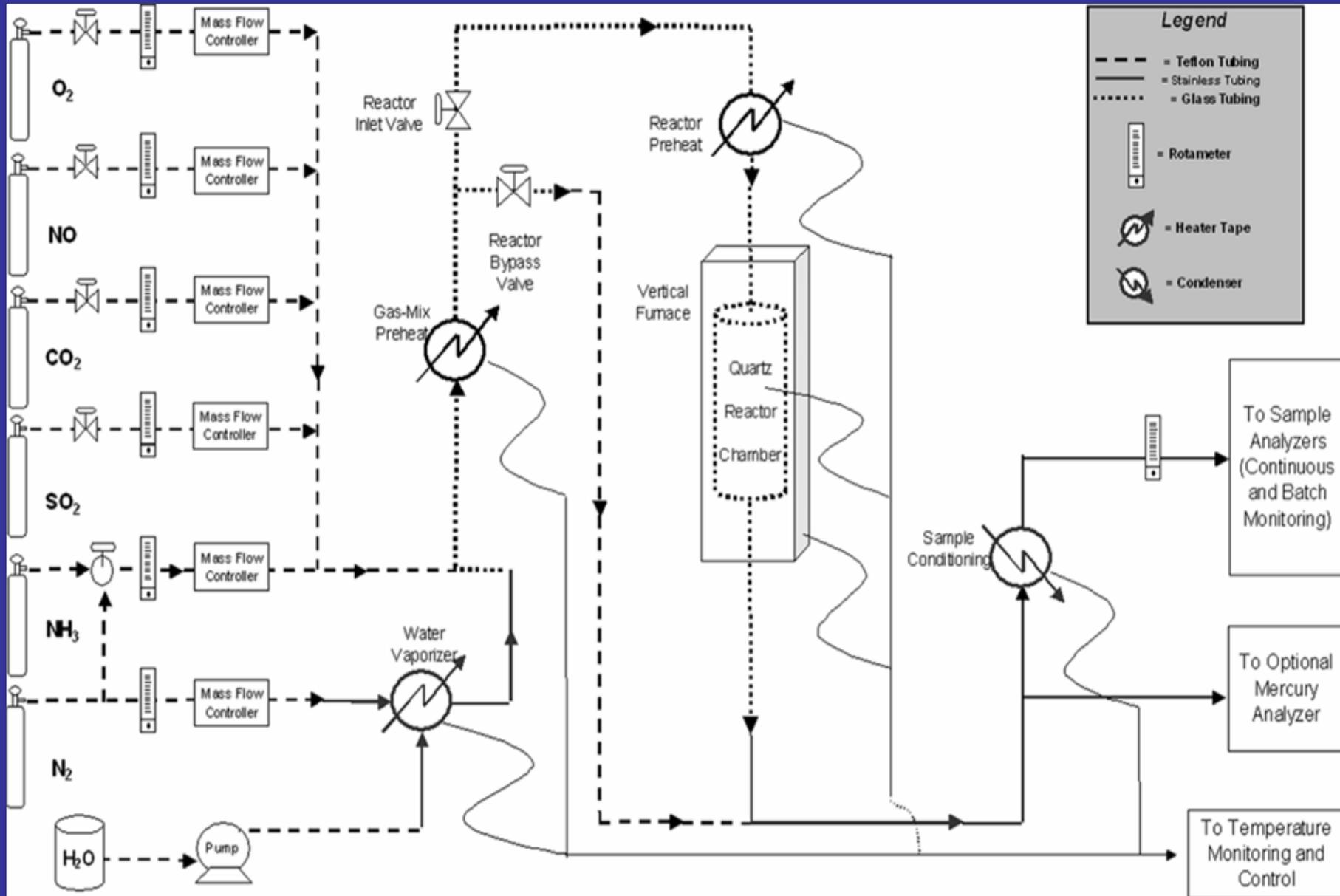
Rate Limited

Overall reaction rate controlled by kinetics of reaction at active site

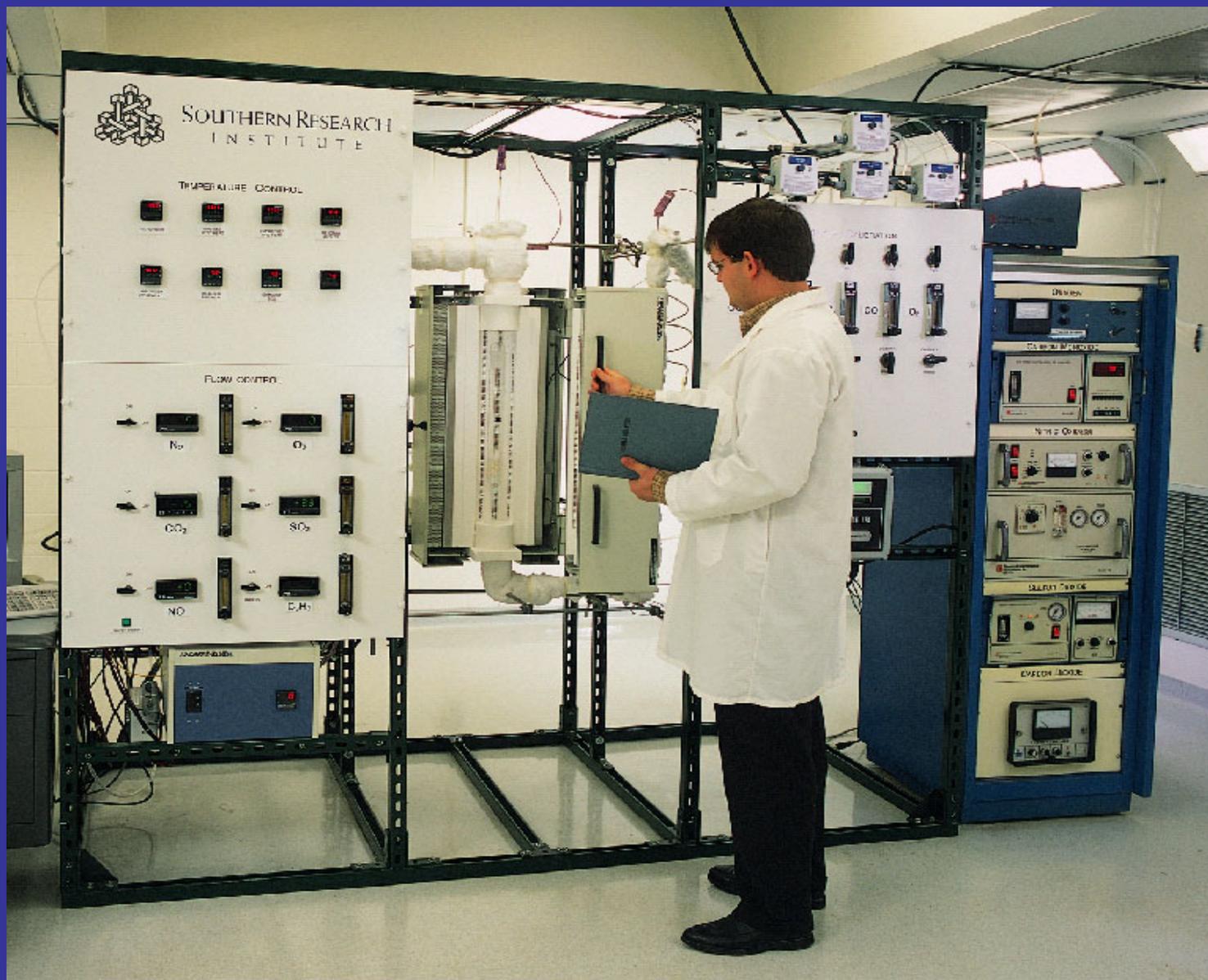
Mass-Transfer Limited

Overall reaction rate controlled by mass transfer – Internal/External Limitations

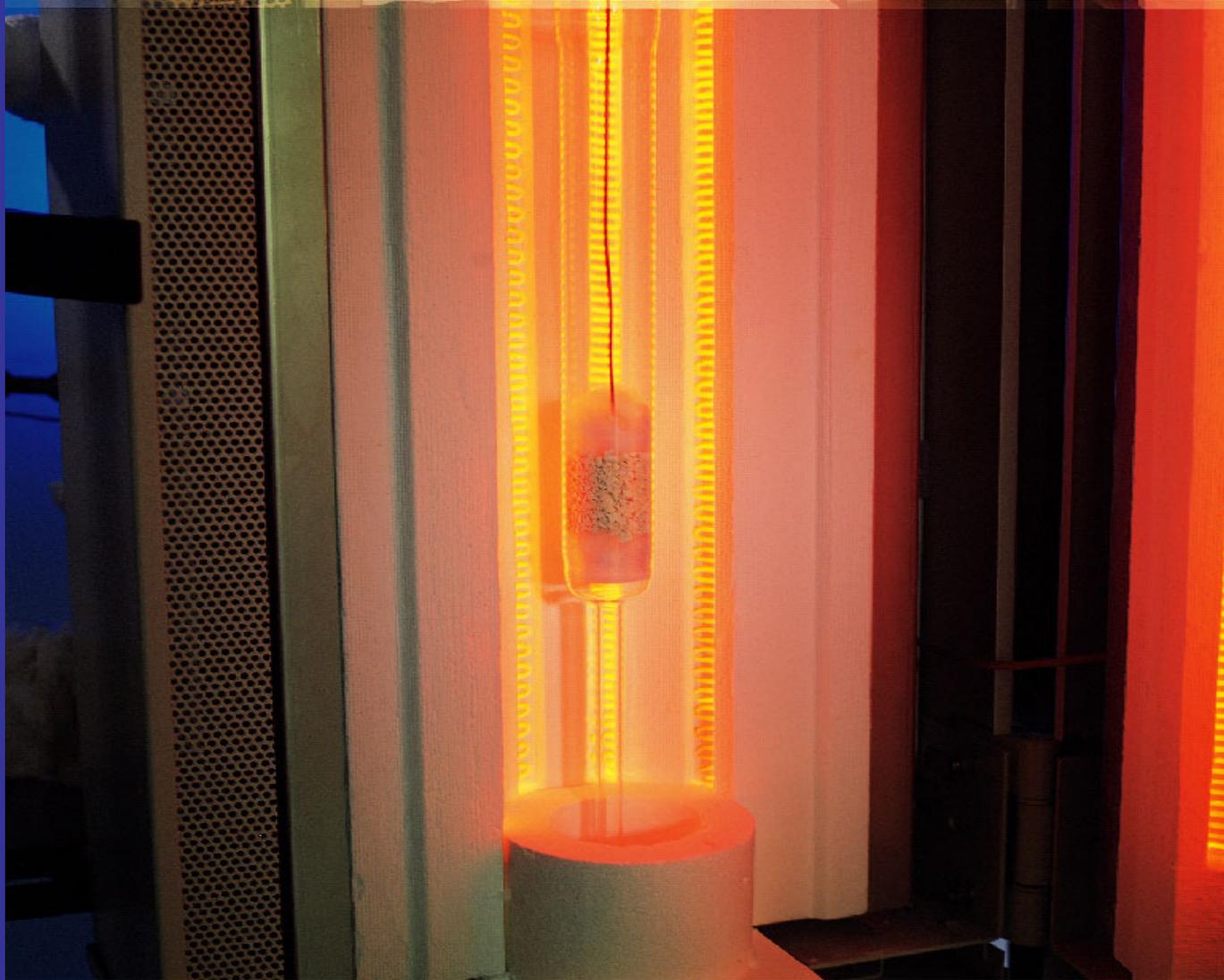
Lab Facility - Schematic



CATALYST TEST FACILITY



REACTOR CLOSE-UP



TEST REACTOR ADVANTAGES/DISADVANTAGES

ADVANTAGES

Inexpensive

Accurate Data

Multiple Conditions

DISADVANTAGES

Must use scale-up factors to predict full-scale deNO_x, slip, and SO₂ Conversion

CATALYST MANAGEMENT

- **Determine remaining activity**
- **Predict life – better planning for catalyst upgrades**
- **Preempt deactivation due to adverse operation**
- **Help maintain optimal performance**

SYSTEM TROUBLESHOOTING

- **Determine if catalyst is source of problem vs. other system components**
- **Determine amount of deactivation and source of deactivation**
- **Minimizes overall troubleshooting cost**

RESEARCH CAPABILITIES

- **Highly controlled parametric tests**
- **Allows multiple formulations to be examined quickly**
- **Can examine parameters difficult to measure in field (SO₂ conversion, mercury oxidation)**
- **Complements larger-scale data – minimizes cost**

CONCLUSIONS

- **Economically attractive test method**
- **Highly controlled conditions – accurate data**
- **Excellent tool for catalyst life predictions**
- **First step in troubleshooting**
- **Primary research tool**