

## Motivation/Challenges

Sorbents are an effective means of removing specific molecules or impurities from gas streams. This is essential as impurities often adversely affect gas properties. For example, CO<sub>2</sub> and H<sub>2</sub>O not only lower the energy content of natural gas but can damage pipelines and equipment. Because of the economic impact impurities can have on gases, there is a significant demand for cost-effective and versatile sorbents and capture technologies.

## Technology/Capability Overview

NETL-RUA is a leader in sorbent technology and application with expertise in all facets of sorbent research, including creation and characterization of new materials, and testing. Moreover, NETL-RUA possesses state-of-the-art equipment and facilities. Researchers have experience with gas separation sorbents in many different environments for **CO<sub>2</sub> capture** and O<sub>2</sub> separation for **Chemical Looping Combustion (CLC)** including:

- Fluid and fixed bed testing
- Pressures up to 400 psig and temperatures up to 900 C
- Moisture contents up to 85%
- Impurities including testing HCl, H<sub>2</sub>S, SO<sub>2</sub>, and NO<sub>x</sub>
- Fuel environments such as H<sub>2</sub>, CH<sub>4</sub>, and liquid fuels

NETL-RUA also offers:

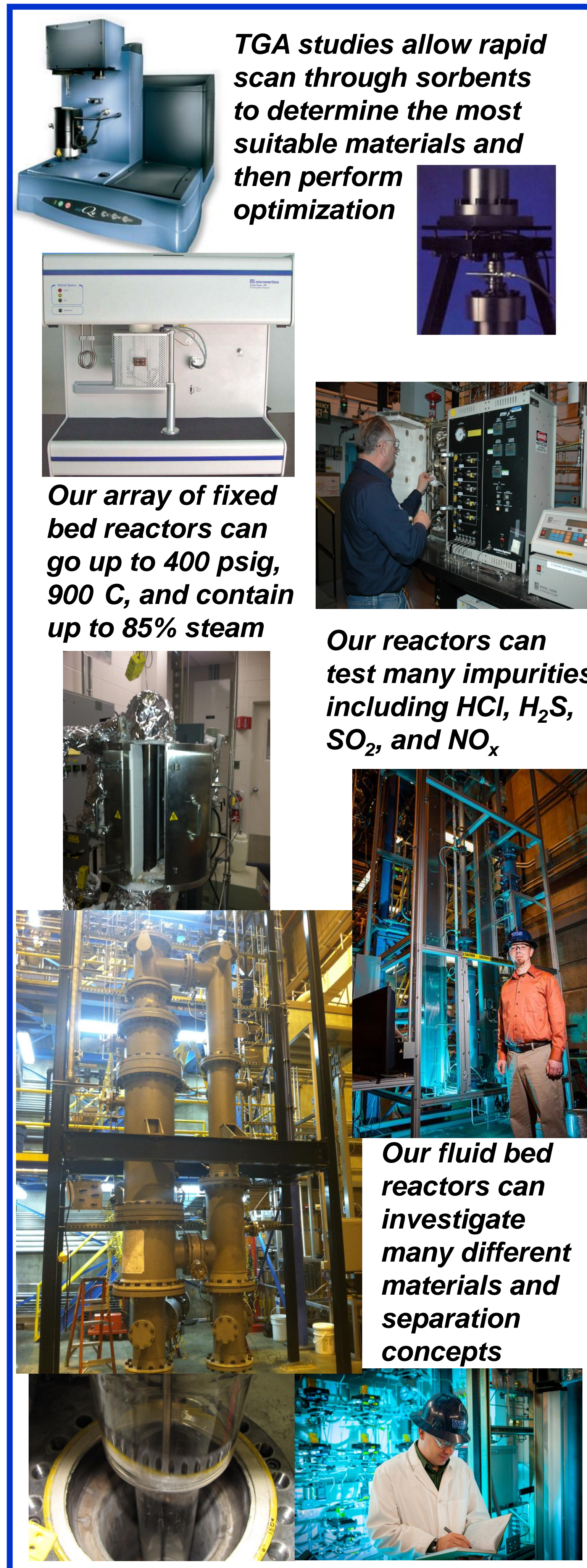
- An ASME 5757 **attrition testing** unit to estimate the life cycle of specific materials.
- Modeling capability for **economic estimates** such as return on investment (ROI), cost of goods and services (COGS), and operating expenses.

NETL has investigated many classes of materials for **CO<sub>2</sub> removal** including:

- Zeolites
- Activated carbon
- Enhanced carbon
- Amine based sorbents
- MOF's

NETL has investigated O<sub>2</sub> **separation via oxygen carriers for CLC**. Materials are being actively investigated include:

- Natural Ores
- Enhanced natural ores
- Synthetic blends of bimetallic-oxides



*TGA studies allow rapid scan through sorbents to determine the most suitable materials and then perform optimization*

*Our array of fixed bed reactors can go up to 400 psig, 900 C, and contain up to 85% steam*

*Our reactors can test many impurities including HCl, H<sub>2</sub>S, SO<sub>2</sub>, and NO<sub>x</sub>*

*Our fluid bed reactors can investigate many different materials and separation concepts*

## Industry Significance

- NETL-RUA uses a multi-disciplinary approach to sorbent research, leading to the generation of innovative products and solutions
- Worldwide need for pure, clean-burning gas is on the rise. Indeed, according to the International Energy Outlook, natural gas is the primary energy source for industrial and electrical power generation.
- Removal of impurities is key to maximizing the value of gas products both in energy content and selling price

## Benefits to Partner

- Access to NETL-RUA's research, knowledge, equipment, and facilities
- One stop shopping' to meet industries' demand for cost-effective and efficient sorbent technology
- Ability to thoroughly characterize and test sorbents prior to any large scale implementation saves significant time and resources

## Opportunity

NETL has several different types of agreements for industrial collaborations. These include Cooperative Research and Development Agreements, Contributed Funds Agreements, and Nondisclosure Agreements. These instruments enable industrial partners to negotiate an agreement suitable for their needs including Go/No-Go decision points to ensure progress aligns with expectations. Once a technology is developed, it could be available for licensing.

## Development Status

NETL has several different technologies at various stages of development. We welcome industry partners at any stage to help guide efforts to their specific needs.

## Contact

More information about working with NETL's Material Science and Engineering Focus Area can be found at:  
[www.netl.doe.gov/onsite\\_research/materials-science.html](http://www.netl.doe.gov/onsite_research/materials-science.html)  
 Or you can contact us directly at: [materials.solutions@netl.doe.gov](mailto:materials.solutions@netl.doe.gov)