



Technology Readiness Level: **4**  
Component and/or Breadboard Validation  
in Laboratory Environment

## Direct Contact Chemical Looping Coal Gasification

***Proprietary oxygen carrier catalysts, chemical looping produces purer synthesis gas, lowers operating costs***

### Benefits

- Reduces plant costs, *(Reduced plant costs arise from the elimination of an air separation unit (ASU), which can save about 20% of plant capital cost)*
- Increases feed flexibility
- Obviates the need for slurry feeding of coal
- Eliminates cryogenic ASU, increasing efficiency and reducing asset investment
- Allows for a much easier separation of CO<sub>2</sub>, CO, and/or hydrogen generated due to little or no entrained nitrogen
- Reduces tarring of internal gasifier surfaces because of the distribution of oxygen carrier in the system

### The Problem

Due to increased concerns about climate change and rising energy costs, demand is growing for cleaner economical processes for power and chemicals production.

### The Solution

Eltron Research & Development has developed a new approach to coal gasification technology that enables synthesis gas production under less severe operating temperatures and pressures. The novel approach results in purer synthesis gas and helps lower operating costs.

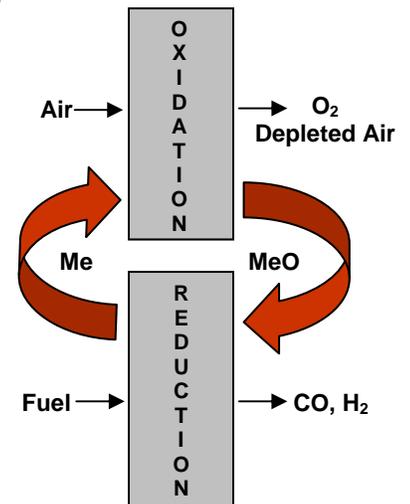
Eltron's new coal gasification technology combines two technologies:

- Chemical looping separation of oxygen from air
- A fluidized or moving bed gasifier

Our approach employs a metal oxide as an oxygen-carrier to separate oxygen from air. The metal oxide is then used as a fluidization medium to carry oxygen to the gasification zone and catalyze gasification reactions.

Eltron has identified inexpensive oxygen carrier materials, (costs ranging from 1.5 cents/lb to 70 cents/lb with preferred carriers costing between 4 and 10cents/lb) and methods for imparting robustness to those materials. A bench-scale, switched feed fluidized bed reactor has been built to demonstrate the principles of chemical looping using these carriers for the gasification of coal, waste, and biomass. A mini-pilot plant utilizing the oxygen carriers and novel features is being designed and fabricated.

Typical processes operate at 1,500°C, which can cause many material problems. Using Eltron's approach, chemical looping gasification at atmospheric pressure and a temperature between 550°C and 950°C has been observed.



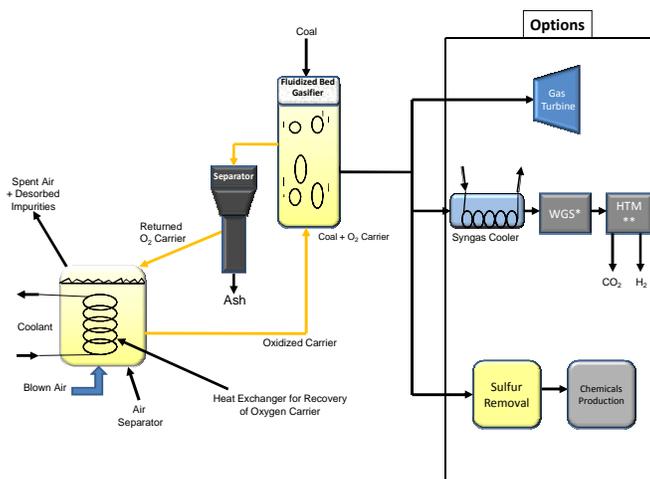
*Diagram of chemical looping scheme for coal, biomass or other solid fuel gasification processes. Oxidation and reduction occur in the two fluidized bed reactors while a metal oxide serves as an oxygen carrier to separate oxygen from air.*

### Features and Benefits

The technology expands on Eltron's previous efforts to improve operational efficiency and reliability and to reduce capital investments for coal gasification. Our approach helps reduce overall operating expenses. Production at less severe operating temperatures and pressures requires less energy and minimizes material problems. The process allows for greater feed flexibility and eliminates slurry feeding of coal. And by eliminating the cryogenic air separation unit (ASU), Eltron's technology significantly increases efficiency and reduces costs.

Another advantage is the fuel itself. Eltron's technology reduces impurity levels in the coal-derived synthesis gas. Unlike air-blown systems, chemical looping produces little or no entrained nitrogen, resulting in a concentrated product stream and allowing for much easier separation of CO<sub>2</sub>, CO, and/or generated hydrogen. This separation leads to better distribution of the oxygen carrier in the system, which in turn reduces the tarring of internal gasifier surfaces.

Our new technology is also scaled for larger systems. The oxygen carrier can be combined with a fluidized bed or a moving bed reactor to produce a single assembly in which coal and oxygen carrier is fed—and Syngas is produced.



*Schematic of Eltron's process concept that employs an oxygen carrier for oxygen separation and coal gasification.*

\*Water-gas shift

\*\*Hydrogen transport membrane

### Stage of Development

A 5kw prototype system is operational. This material is based upon work supported by the Small Business Innovation Research program of the U.S. Department of Energy, Grant Number DE-FG02-05ER84200.

*Eltron has related patent applications filed with the USPTO:*

- 11/858,564 Cyclic Catalytic Upgrading of Chemical Species Using Metal Oxide Materials

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### Contact Us

To discuss the possibility of entering into a business relationship with Eltron, contact the Business Development Group at [business@eltronresearch.com](mailto:business@eltronresearch.com).



### Eltron Research & Development Inc.

Eltron Research & Development Inc. invents and commercializes novel technologies involving advanced materials, energy, water and environmental systems.