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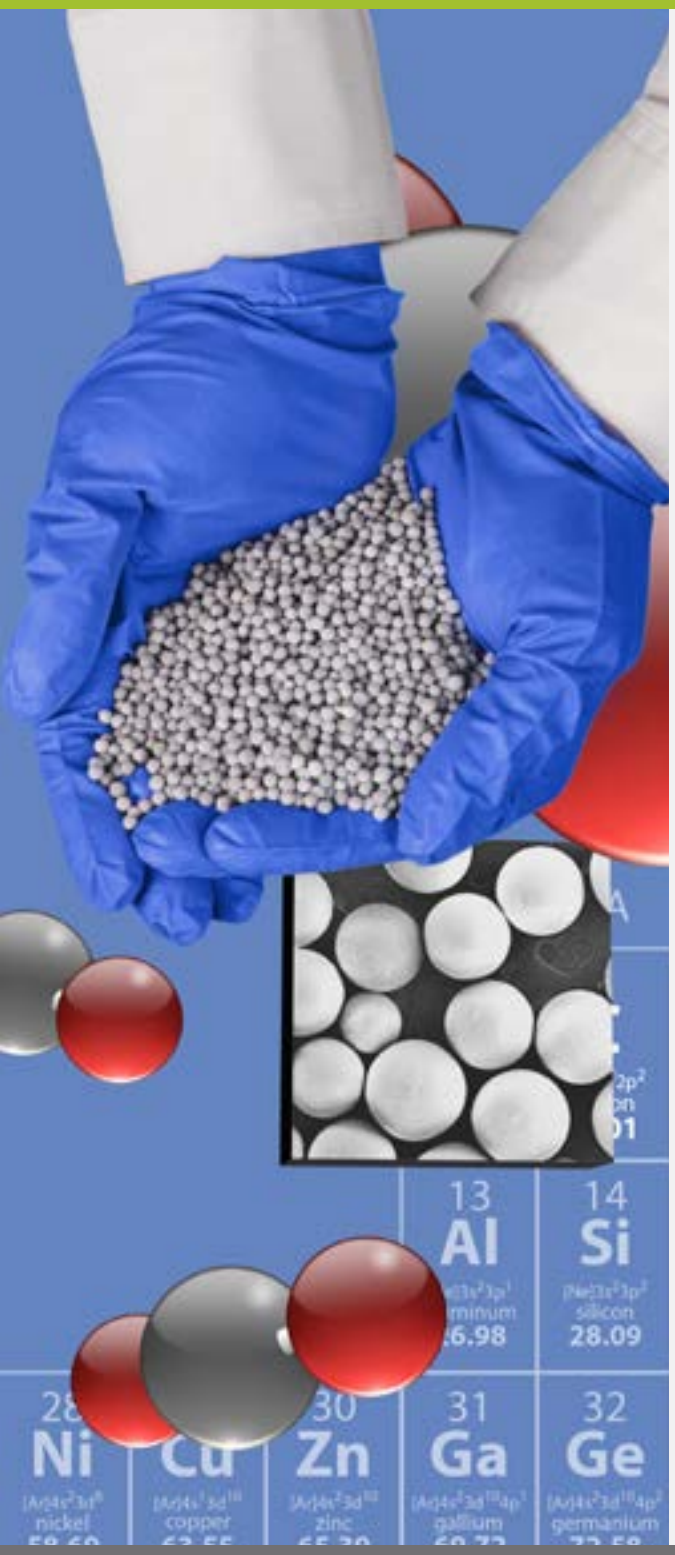
NATIONAL ENERGY TECHNOLOGY LABORATORY

## Pelletized Basic Amine Sorbents Using Fly Ash and Polymer Binders




### Opportunity:

Researchers at the U.S. Department of Energy's National Energy Technology Laboratory (NETL) have developed a method of basic immobilzed amine sorbents (BIAS) pelletization which incorporates low cost additives (fly ash for added strength and a poly[chloroprene] [PC] binder) producing sorbent pellets displaying high carbon dioxide ($CO_2$) capture capacity, excellent cyclic stability under practical conditions, and superior attrition resistance in a dynamic environment. As such, these pellets represent a cost-effective, highly efficient technology for commercial-scale $CO_2$ capture. The technology

### Overview:

Carbon sequestration is considered essential to significantly reducing $C0_2$ emissions. Basic immobilized amine sorbents (BIAS) have been demonstrated at bench and pilot-scales to be a highly promising means of post-combustion $C0_2$ removal. Wide-spread application of BIAS, however, will require pelletization to make these materials compatible with commercial reactors. Conventional methods of making BIAS pellets tend to result in pellets that lack mechanical strength, have reduced $C0_2$ binding capacity relative to the particle form of sorbent, and/or lose their ability to bind $C0_2$ after multiple adsorptiondesorption cycles. Thus, there is a need for BIAS pelletization methods that are scalable, low-cost, and maintain sorbent $C0_2$ capture capacity and efficiency.

A BIAS pelletization method, involving extrusion of a wet paste into pellet shapes, well suited for semi-continuous scale-up has been developed. Pelletization is achieved via the novel combination of inexpensive, readilyavailable fly ash (FA) as a strength additive and low-cost, hydrophobic poly(chloroprene) (PO as a binder. The combination of FA strength additive and PC imparts both high strength and flexibility to the pellet, ideal for

(continued)

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performance in a dynamic environment. The resulting BIAS/FNPC pellets possess high mechanical strength, attrition resistance, $C0_2$ capture capacity, and long-term $C0_2$ capture stability. The pelletization process is simple, lowcost, and scalable producing pelletized sorbents that can be used for packed beds, moving beds, and other reactor configurations. The pellets can also be used under both pressure and temperature swing conditions.

## Significance:

NETL's pelletization technology:

- Provides an economical and scalable method for pelletization of amine-based sorbents
- Generates BIAS pellets possessing high mechanical strength and $CO_2$ capture capacity and efficency
- Produces hydrophobic sorbent pellets for effective and cyclic $CO_2$ capture stability, even under practical humid conditions
- Yields sorbents with reduced energy demands, minimizing the overall cost of $CO_2$ capture.

## Applications:

$CO_2$ capture for coal and natural gas combustion plants, Marcellus shale gas cleanup, cement production plants, confined spaces such as submarines and space shuttled/stations, landfills and aerobic digesters for biogas cleanup, and waste incineration units.

## Related Patents and Patent Applications:

- Provisional Patent Application (**S-140295**), titled "A Pelletized Basic Immobilized Amine Sorbent (BIAS) Utilizing Fly Ash and Polymer Binders" has been filed. Inventors: Walter Wilfong, McMahan Gray, and Yee Soong
- U.S. Nonprovisional Patent Application No. **15/156,773** filed May 17, 2016, titled "A Pelletized Immobilized Amine Sorbent for $CO_2$ Capture." Inventors: Walter Wilfong, McMahan Gray, Yee Soong, and Brian Kaild.
- U.S. Patent No. **8,834,822**, issued September 16, 2014, titled "Regenerable xmmobilized Aminosilane Sorbents for Carbon Dioxide Capture." Inventors: McMahan Gray, Christopher Jones, and Sunho Chai
- U.S. Patent NO. **8,500,854**, issued August 2013, titled "Regenerable Sorbent Technique for Capturing $CO_2$ Using Immobilized Amine Sorbents." Inventors: Henry Pennline, James Hoffman, McMahan Gray, Daniel Fauth, and Kevin Resnik

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