

## Binder-free Pelletization Process

Sandia National Laboratories is introducing a binder-free pelletization process to fabricate industrially relevant pellets of porous catalysts and separations materials. This process enables the implementation of oxide based materials into industrial process with full access to surface area and reactivity of the base material.



Left: Binder-free ZIF-8 pellets

Below: Two examples of pellets made from different compounds.



### Goal

Enable the pelletization of a wide range of materials in their pure form, without reducing performance.

### Pelletizing Pure Porous Oxide Materials

A binder-free pelletization process allows for the processing of crystalline powder, porous oxide materials into industrially relevant pellet shaped pieces with no reduction in sorption capacity or accessible surface area of the porous oxide material. This technology is successful with a wide range of sorptive and catalytic materials, such as zeolites, molecular sieves, clays and MOFs. The shape of the formed pellet can be carried to address the needs of the target engineered system. Because there is no binder, 100% of the relevant properties of the material are retained and accessible, resulting in no diminished performance. The final pellet is as chemically, mechanically and thermally durable as the original porous phase. As such, it can be later processed as the original powder, such as back flushed of sorbed material, regenerated for catalysis, or incorporated into a glass for a nuclear waste form.

### Implementing Novel Materials

Novel materials for industrial applications in separations and catalysis are being developed worldwide. However, implementation of those materials into industrially relevant, pre-existing, and environmentally conscious ways requires the transformation of the materials into usable forms. Catalysts and separations materials made of crystalline porous metal oxides need to maintain their surface area and their reactivity under

industrial process temperatures and pressures. However, they must retain their physical integrity during multiple industrial cycles. If fabricated as high static powders, their morphology can clog the flow of gas/liquid streams. Pelletization is the key to transforming the morphology to a usable form. Our technology uses a binderless technology process to form shapes and sizes of interest with no loss of oxide surface area or sorption capacity.

### Commercialization Path

Sandia is exploring business arrangements with commercial vendors to (1) identify and/or provide microporous and/or mesoporous materials for the formation of novel pellets, (2) the partnership of scaled-up processing of those materials via the SNL process, (3) the design, building and testing of that automated processing unit, and (4) the collaborative pellet production and process (eg., sorption) testing at Sandia. The expected cost of this scale up demonstration unit and testing is in the \$2-3 million range and is expected to take 3 years. Cost sharing with the Department of Energy under Multiple Party CRADAs is a possibility. Establishment of Consortia is also being considered.

At the end of the successful demonstration, the expectation is that vendors of commercial power cycle equipment will adopt the technology and place it on the commercial market.

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