

## Panelists set optimistic timeline for coal-derived carbon materials

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By Ellie Potter *Market Intelligence*

Using coal to create products such as carbon fibers, fertilizers, resins and building materials could create a new source of demand for a fuel struggling to compete in the domestic power market, panelists said at a recent industry event.

Ramaco Carbon LLC CEO Randall Atkins said during a Feb. 1 panel at the 19th Coaltrans USA conference in Miami that China uses an estimated 200 million to 300 million tons of coal a year to produce chemicals, and there could be a similar market in the U.S.

"I think there's a fascinating opportunity, not only to help the coal industry from the standpoint of creating the potential for more jobs — because we could basically mine coal for better margins than most of the thermal coal is mined for today for utilities — but also to repurpose a lot of old mines" and revitalize the communities that depended on them, he said.

Atkins thinks that building materials made with coal could be commercialized in the next two to three years. More complex products, such as the coal-derived carbon fibers his company is working to develop, would take a bit longer.

Edgar Lara-Curzio, leader of the mechanical properties and mechanics group at the Oak Ridge National Laboratory in Tennessee, said that while carbon fibers developed from petroleum have been commercialized, coal-derived carbon fibers may enter the commercial market within five years.

Carbon fibers are stronger and lighter than steel and aluminum and could replace those materials in products such as car parts, Atkins said, but the fibers are eight times more expensive because the precursor material is made from petroleum.

"We think ... we can drive that precursor cost down, from roughly \$25 to \$30 a pound to below \$5 a pound," Atkins said in an interview, "And at that point, it becomes a game-changer."

Jeffrey Grossman, a professor in the materials science and engineering department at the Massachusetts Institute of Technology, said, "The opportunities are tremendous" for coal given its value and inherent chemistry. Developing carbon for commercial use is an expensive process, but one that could be simplified by extracting it from coal.

Coal's chemical structure makes it more suitable for manufacturing than natural gas, according to Matt Targett, director of Ramaco Carbon's research and development, who said coal is "halfway there in terms of these enhanced carbon products that we're talking about."

The U.S. Department of Energy is also researching how to derive graphene, a valuable, highly conductive and very strong component of graphite, from coal. Graphene is expensive, costing about \$20 a gram, but using coal as a feedstock may help reduce the cost, said Christopher Matranga, a research scientist in the materials and manufacturing division of the National Energy Technology Laboratory.

Private-sector investment in coal-to-products research has been "fairly nominal" so far, Atkins said. He is working with the National Coal Council on a paper to send to U.S. Energy Secretary Rick Perry in April explaining some new ways to use coal, which Atkins hopes will spark more awareness of opportunities within the department.

Matranga cautioned that coal-derived products might not be feasible at a price point the market will support.

"I think there's demand for the types of products we're creating, the types of materials with the properties we have," Matranga said. "I don't know that anybody is screaming that it has to be done with coal."