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1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

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## Inventors

**Dong-Kyun Seo**

## Contact

Physical Sciences Team

# Production of Carbon Materials and Metal Oxides Using Liquid Metal Cathodes

-Background Electrolytic reduction of metal carbonates in molten salts at elevated temperatures have attracted attention over the past decade as a new way of producing various materials such as carbon materials and metal oxides. These carbon materials can be in various forms including carbon nanotubes, nanofibers, aggregates, amorphous carbon, graphene, or graphite. Upon reduction of carbonate ions at or near the surface of a solid metal cathode, carbon material forms and grows on the cathode surface and can often be difficult to separate. In some cases, metal oxide particles form and can be intermingled with the carbon materials, further complicating the task of economically separating the products from the cathode. Invention Description Research at Arizona State University has led to the development of a liquid metal cathode in a molten salt electrolytic cell for production of carbon materials, metal oxides, or both. Since the surface of the liquid metal does not have a rigid structure, the carbon materials formed by reduction of carbonate do not adhere permanently to the liquid metal surface. The carbon materials are formed at the surface of the liquid metal cathode, in the vicinity of the liquid metal cathode, or both. Separation of the carbon materials and metal oxides produced in the electrolytic cell can be achieved by mechanical separation. Potential Applications Low carbon-emission production of: • Carbon materials including carbon nanotubes, carbon fibers, aggregates, graphene, and Portland cement • Metal oxides Benefits and Advantages • Generates carbon materials and CaO with reduced or no carbon dioxide emission • Carbon materials and metal oxide are easily separable by filtration or gravity Faculty Profile of Professor Don Seo