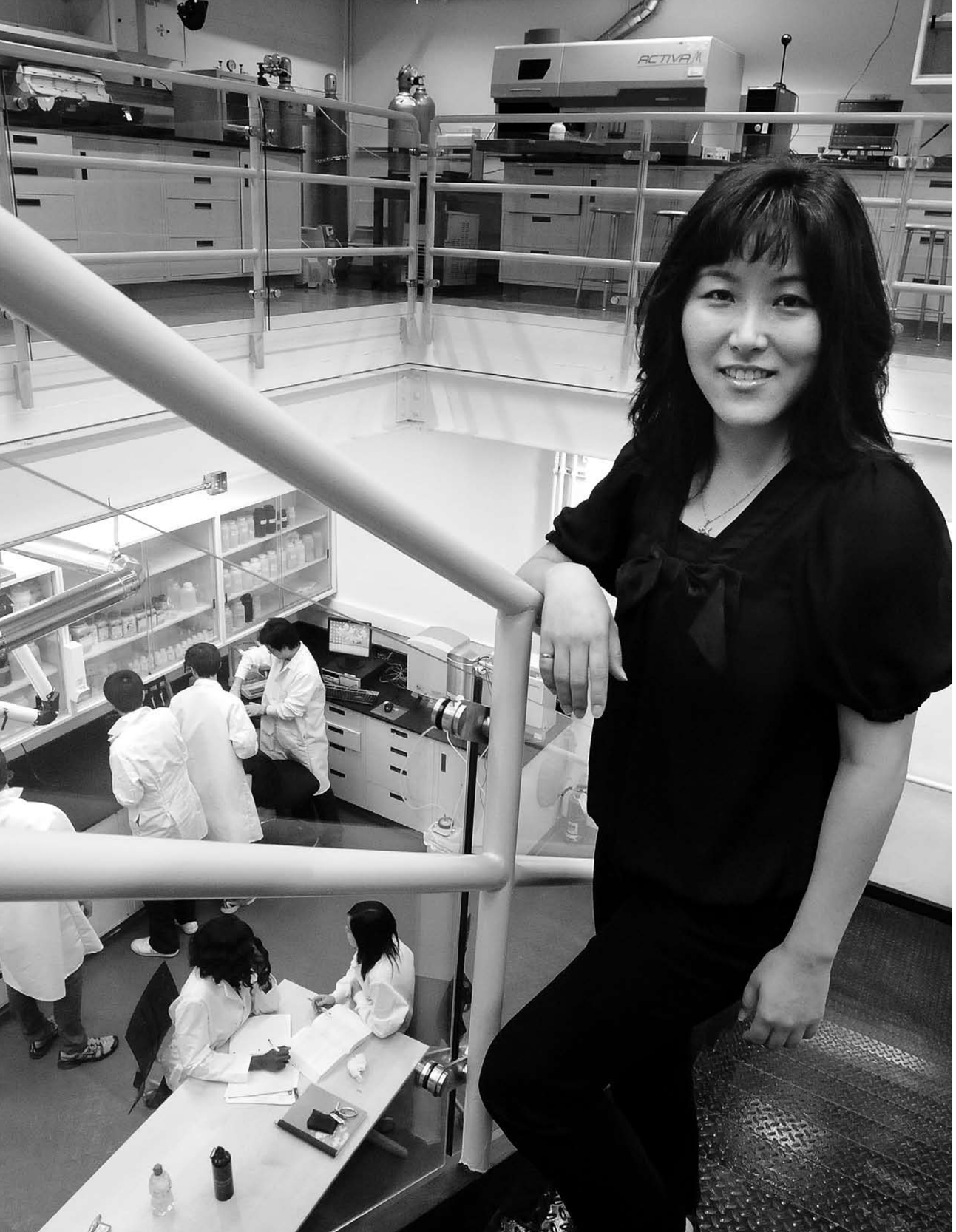

Capturing Carbon

AH-HYUNG (ALISSA) PARK
EARTH AND ENVIRONMENTAL ENGINEERING

Ah-Hyung (Alissa) Park has been called the "Carbon Lady" for good reason. She is considered to be one of the leading experts in the many forms carbon takes as humans transform and move it through society and the environment, and her path-breaking work may very well help pave the way to a future in which society obtains energy from a wide range of sustainable sources and deals with its excess carbon in surprising ways.

"The future of humanity depends on our ability to use energy and materials with an eye toward environmental sustainability," said Park, Lenfest Junior Professor in Applied Climate Science and associate director of the Lenfest Center for Sustainable Energy. "This will inevitably have to include efficient extraction of energy and materials from fossil resources, biomass, and municipal solid wastes."

Whether carbon takes the form of a lump of coal or a used plastic soda bottle, or becomes the end result of carbon capture and sequestration, Park looks for methods to improve the ways that carbon circulates through the industrial and environmental processes. "The reason we take so much carbon out of the ground is because of our needs for energy and materials," said Park. "If we can find a way to keep the carbon circulating above ground while providing energy and materials, we won't have to take so much out of the ground."

More than seven gigatons of carbon produced by human activity around the world ends up in the atmosphere each year, primarily in the form of the greenhouse gas carbon dioxide. Being able to manage our increasingly prominent role in the global carbon cycle is an important and innovative step toward the sustainable future of our society.

One of the ways Park attempts to do this is to investigate novel ways to integrate carbon capture and storage technologies with those that synthesize hydrogen and liquid fuels from coal, biomass, and municipal solid wastes, including nonrecyclable plastics.

Today, Park is also working to advance efforts to capture carbon dioxide from emissions and lock it away permanently and economically. To do this, she is exploring the use of nanoparticle ionic materials (NIMs), a new class of organic-inorganic hybrid materials that consist of a hard nanoparticle core surrounded by a functionalized corona. NIMs are essentially solvent-free, particle-based fluids that provide a large number of capture sites for CO_2. Since it has negligible vapor pressure, NIMs can be applied to various industrial processes with minimum environmental impacts.

Once the carbon dioxide has been captured, Park is also looking at ways to safely and permanently dispose of it as mineral carbonates or to convert it to other useful materials such as paper or plastic fillers. The key to achieving sustainability, she says, is to take a more expansive view of the systems that process carbon.

"In the past, engineering has mainly focused on optimizing the individual unit of a process," said Park. "Today, we need to look at the big picture and add environmental sustainability to our equations."