Novel manufacturing method could lead to massive energy savings, new materials

August 10 2017, by David Kubarek

Penn State researchers have developed a new method for sintering, a widely used manufacturing process for powdered materials. Using far less time and energy than the standard approach, the new method could have global implications on manufacturing and energy savings and pave the way for new discoveries.

Cold sintering, a process devised by a team led by Clive Randall, professor of materials science and engineering and director of Penn State's Materials Research Institute, is a new take on sintering, a process through which powder-form materials are densified—compressed—using heat and pressure. Sintering is used to manufacture many materials including glass, metals, bricks and plastics.

Randall's approach uses liquid to complete the sintering process at times and temperatures that are a fraction of current methods. Because the process is completed in minutes instead of hours, time and energy savings could result in huge productivity and cost gains for the manufacturing sector and could lead to far fewer greenhouse gas emissions from manufacturing.

"What we're doing is using a liquid in a dissolution process. It then works by an evaporation process," he said. "That's been done before but usually with phases that aren't transient. What's really important about this process is that this liquid is there and then it's gone, and in the process of being there and gone it's capturing all the exchange and diffusional and growth processes that you need to drive the sintering."

Because traditional sintering occurs over many hours at temperatures around 1,000 degrees Celsius, and cold sintering takes place at temperatures from room temperature to 200 degrees Celsius, the process has opened the door for novel manufacturing materials that can't sustain the higher temperatures of traditional sintering.

"The ability to incorporate new materials into that whole process and make new types of functionality and then finally to have a system where it's basically densified in 20 minutes means that your through-put and your manufacturing yields could go up enormously," Randall said. "This is great for manufacturing, it's great for energy savings, it's great for the environment and it's now permitting new intellectual endeavors in making materials."

Provided by Pennsylvania State University