New process promises to revolutionize manufacturing of products

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A new "smart materials" process - Multiple Memory Material Technology - developed by University of Waterloo engineering researchers promises to revolutionize the manufacture of diverse products such as medical devices, microelectromechanical systems (MEMS), printers, hard drives, automotive components, valves and actuators.

The breakthrough technology will provide engineers with much more freedom and creativity by enabling far greater functionality to be incorporated into medical devices such as stents, braces and hearing aids than is currently possible.

Smart materials, also known as shape memory alloys, have been around for several decades and are well known for their ability to remember a pre-determined shape.

Traditional memory materials remember one shape at one temperature and a second shape at a different temperature. Until now they have been limited to change shape at only one temperature. Now with the new Waterloo technology they can remember multiple different memories, each one with a different shape.

"This ground-breaking technology makes smart materials even smarter," said Ibraheem Khan, a research engineer and graduate student working with Norman Zhou, a professor of mechanical and mechatronics engineering. "We have developed a technology that embeds several

memories in a monolithic smart material. In essence, a single material can be programmed to remember more shapes, making it smarter than previous technologies."

The patent pending technology, which is available for licensing, allows virtually any memory material to be quickly and easily embedded with additional local memories.

The transition zone area can be as small as a few microns in width with multiple zones, each having a discrete transition temperature. As the processed shape memory material is subject to changing temperature, each treated zone will change shape at its respective transition temperature. As well, transition zones created side-by-side allow for a unique and smooth shape change in response to changing temperature.

Several prototypes have been developed to demonstrate this pioneering technology.

One mimics a transformer robot. The robot's limbs transform with increasing temperature at discrete temperatures, whereas in conventional shape memory technology this is limited to only one transformation temperature.

Provided by University of Waterloo