

**Unexpected Method to Manufacture Ceramic Body Armor**

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Ceramic body armor provides great protection but can also be difficult to manufacture, notably in combining materials to create a strong composite. Ceramic armor stops bullets by shattering them or reducing their penetrative ability, but this depends on how porous the ceramic is.

US Army researchers have devised a method to produce ceramic body armor, lightweight but strong, from a 3-D printer. "For ceramics, that's a bit of a challenge because with you can't really do a one-step additive manufacturing process like you could if a metal or a polymer," said Lionel Vargas-Gonzalez, a researcher at the Army Research Laboratory.

He sees 3-D printer ceramics as the "next avenue for armor because we're going to be able to, in theory, design armor in a way that we can attach multiple materials together into a single armor plate, and be able to provide ways for the armor to perform better than it can be just based on one material alone."

Even though it wasn't in the printer manufacturer's manual, Joshua Pelz, a materials science and engineering doctoral candidate at the University of California San Diego, figured out how to hack the printer. "Two syringes containing distinct, viscous ceramic slurries are connected to a custom-made auger and print head," ARL said. "Pelz took advantage of his computer programming skills to hack into the 3-D printer, tricking it into using its own fan controls to manipulate the ratio of materials being printed. He designed a custom auger and print head and even used the same 3-D printer to create those parts."

Now the question is who can produce it the armor. If it's technically possible— and now legal in the United States — to print 3-D guns, and it's also feasible to print ceramic armor, then the possibilities are immense. But not necessarily for the better, writes nationalinterest.org.