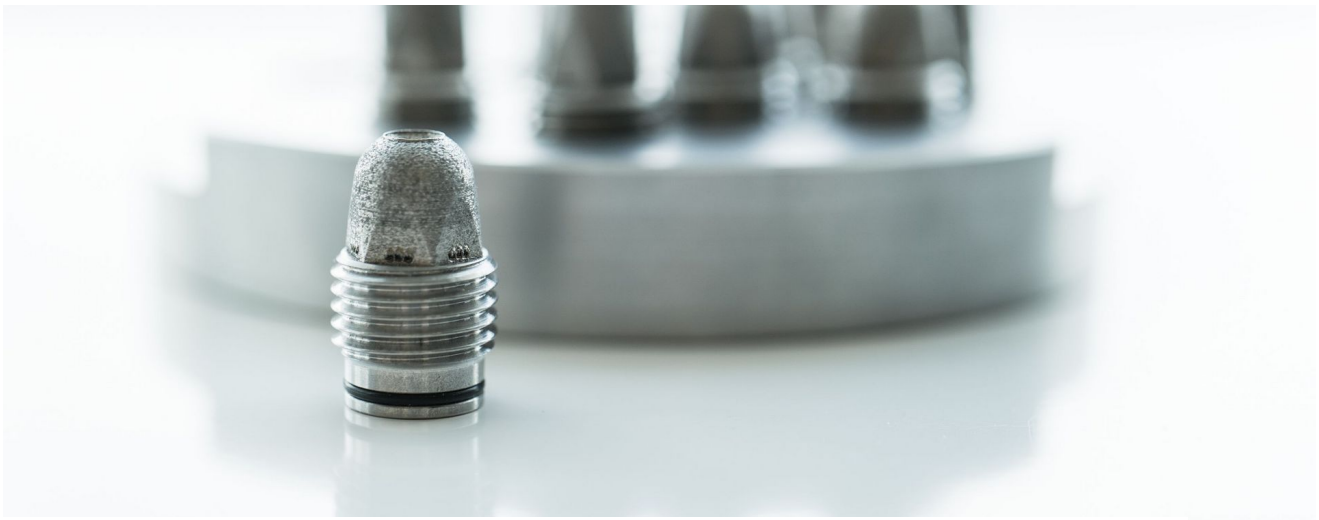

RAMONA HÖNL

Cleanly printed

In a project with USB-Düsen and Heilbronn University, TRUMPF has optimized sewer cleaning nozzles for 3D printing. A subsequent test series has shown that the 3D-printed variant clearly performs better than the conventionally manufactured nozzles.

To clean large sewer lines, workers plug a hose into vehicle-mounted machine, at the end of which is a ‘bomb’ or ‘grenade’ that slides down channels on a carriage. The head of the bomb is fitted with 12 to 15 nozzles that spray water. These jets hit channel walls at pressure levels up to 300 bar to blast away the sludge, which is then sucked into the vehicle via the hose.

Simple components, complex production

The nozzles’ design is simple, but it still takes four steps to manufacture these attachments. The first is to cut the raw material and then thread it on a lathe to create what is in effect a massive bolt. Then two blanks are placed in a milling machine to cut the contours of a nut into the front face. Finally, a worker glues in a ceramic insert by hand. “The operator has to remove the component from the machine for each step. What’s more, gluing often leaves imperfections that change the jet’s guidance,” says Fatih Arikcan, additive manufacturing application engineer at TRUMPF, with a note of disapproval. TRUMPF decided to go with additive manufacturing to cut production time while boosting cleaning performance.

Its experts took a hybrid approach for the new nozzles, combining conventional and additive processes. They stuck with the lathe for the massive threaded base component, which is called a preform. "This process is solid. AM doesn’t add any value here,” says Arikcan. The 3D printer is to perform the following steps, milling and gluing. TRUMPF opted for Laser Metal Fusion (LMF), a manufacturing process where a laser builds up the component layer by layer in the powder bed. “This process is perfect for complex geometries. We need these to put these functions – that is, maximum cleaning performance with minimum water consumption – into practice,” explains Arikcan.

Series production possible for the first time

TRUMPF experts streamlined the component's design so it can be printed without any supporting structures, and with no finishing to be done afterwards. This printing process is software-driven, so the imperfections associated with manual gluing have been relegated to history. TRUMPF staff enlarged the nozzle attachment and added an outer channel guide to improve the component's properties. This serves to furnish air to the system and creates a tighter throw pattern when the jet hits the surface to be cleaned. The preforms with the add-on component can be screwed into the bombs immediately upon printing. The substrate plate does not even have to be removed from the machine to do this. "For the first time, this will allow 10,000 nozzle inserts to be manufactured per year," notes Arikcan.

3D printing scores all along the line

TRUMPF experts set up a test bed to examine and validate the 3D-printed components. "Measurements have shown that this shortens the job time for conventional steps by 53 percent," says a clearly delighted Arikcan. The parts were made with the TruPrint 1000 3D printer; developed by TRUMPF, it features a single laser. This expert is confident that the time savings will be even greater with a multi-laser system. The new nozzles also deliver more persuasive performance with benefit of improved jet guidance. "We demonstrated that the water jet flows smoother than with the conventional design. We also expect the pressure on the surface to increase and water consumption to decrease," says Arikcan. Another positive side effect is that this boosts turning and milling stations' availability.

3D-optimized sewer cleaning system: This 3D-printed nozzle for sewer cleaning systems was optimized by TRUMPF.

Preforms in TruPrint 1000: A fixture holding preforms in the 3D printer's build chamber

TruPrint 1000: TRUMPF's TruPrint 1000 3D printer

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