Presse Release
Amphos Laser

TRUMPF laser generates nanoparticles in record time

World's fastest nanoparticle production // Ultrashort pulse laser fires 40 million pulses per second at metal plates // Research team honored with Fojtik-Henglein Prize

Ditzingen, June 2018. Nanoparticles can enhance the surfaces of many products, making eyeglass lenses more scratch-resistant, house paint more moisture-repellent, and prostheses and implants more biocompatible with the human body. Manufacturing nanoparticles for industrial use is still a costly and time-consuming business – but now a team of researchers at the University of Duisburg-Essen has succeeded in producing several grams of nanoparticles in just one hour with the TRUMPF AMPHOS 500flex laser system. On June 7, 2018, the scientists received the Fojtik-Henglein Prize for their proof of concept at the ANGEL conference in Lyon, France. This award recognizes groundbreaking published research into laser and nanoparticle colloids.

Nanoparticle production takes too long

One way of producing nanoparticles is to fire a laser at a metal plate made of platinum, gold or silver. The metals are placed in a liquid such as water and the laser beam is then focused through this medium. The nanoparticles produced in this process are collected in the container and can subsequently be processed together with the liquid. However, this method has proved to be far too time-consuming for industrial applications. A nanoparticle measures just eight nanometers, which is a thousand times smaller than a bacterium. That means the laser beam has to hit the surface of the metal plate several billion times to ablate one gram of nanoparticles. The cavitation bubble that forms on the metal surface each time it is struck by the pulsed laser also slows things down. When the laser pulse hits the plate, the energy density spikes, briefly attaining a level high enough to shield the next laser pulse and prevent the ablation of new particles. The cavitation bubble generated by the laser pulse has to collapse before the current methods can continue producing nanoparticles. This can take up to one millisecond, causing a corresponding delay in the process. The researchers have now solved this problem with their breakthrough.

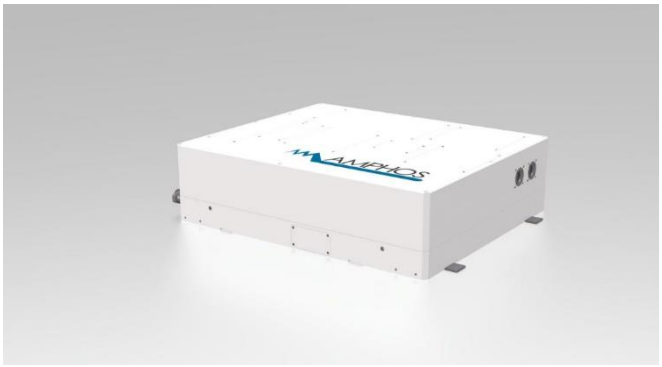
Laser system generates 40 million pulses per second

Bilal Gökce's team of researchers at the University of Duisburg-Essen accomplished this with a very powerful 500flex ultrashort pulse laser (USP) made by the TRUMPF subsidiary Amphos. This USP laser generates over 40 million pulses per second, each with a duration of three picoseconds. The system also features a scanner that realigns the laser pulse shielded by the cavitation bubble.

That makes this system remarkably efficient, because the laser beam can simply ablate the next nanoparticles from a different spot while the cavitation bubble is collapsing. Gökce and his team were able to show that this method produces up to four grams of nanoparticles per hour. A yield as high as this makes it feasible to use this process for industrial applications.

Ultrashort pulse lasers for scientific applications
Amphos GmbH joined TRUMPF in January 2018, enriching the product portfolio with powerful and flexible short and ultrashort pulse lasers. Amphos offers off-the-shelf devices as well as customized lasers with individually adjustable parameters. The research team from Duisburg-Essen works with the latter, a purpose-built laser engineered specifically for this process.

Bilal Gökce (second from left) from the University of Duisburg-Essen with the ANGEL conference jury at the award ceremony in Lyon



An AMPHOS ultrashort pulse laser

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