Powerful new laser to boost car manufacturing

With the ability to cut and shape ultra-high-strength boron steel up to one thousand times faster than existing technology, a new precision pulse laser looks set to boost the car industry with a 10% reduction in waste products, a 5% reduction in chassis costs, and a two-third decrease in manufacturing time.

European scientists are developing a new 'pulsed' laser system, similar to the 2018 Nobel Prize in Physics winner, to cut and shape ultra-high-strength industrial materials that are notoriously difficult to process at unimaginable speeds, while producing considerably less waste.

Operating at 1.5 kilometres per second, the new laser will be powerful enough to cut the hardest boron steel used in car construction at one cubic centimetre per minute - over a thousand times faster than existing technology that currently ablates steel at one cubic millimetre per minute.

Exerting an average power of 2.5kW, or 100kW in a single pulse, and with repetition rates up to 1GHz (or 1 billion cycles per second – a thousand times more than the current 1MHz upper limit), the laser will have the control and refinement to etch moulds for vehicle parts at micron-scale accuracy as well as micro-weld dissimilar metals for solar thermal absorbers.

Commonly used in laser eye surgery, pulsed lasers send out short blasts of energy, or 'pulses', in tiny fractions of a second. The pulses in this new laser are so fast that their duration is measured in femtoseconds – a femtosecond compared to a second is in the same ratio as one second to 32 million years.

Aiming to improve car manufacturing speed and efficiency, while reducing the potential production costs and environmental impact, the new pulse laser system has received a €5 million development grant from the European Commission.

Boron Steel Cutter

Boron steel, which is used in car bodies because of its super strength, is so durable that it is often difficult to cut or shape. The processes used to ensure its durability usually remove many of the steel's fundamental properties, such as the workability.

Although boron steel can be cut with a plasma arc torch, (a tool that cuts using high pressure, accelerated jet of hot plasma), this can instantly heat the metal to over 650°C (1,200°F) and is not as precise or as quick as a pulse laser.

Going by the acronym 'PULSE', the consortium behind the powerful new laser draws on expertise from eleven research institutions and industry partners from six different European countries and is coordinated by Tampere University in Finland.

Project coordinator, Dr Regina Gumenyuk said:

“While ultrashort-pulse laser (USPL) technology has been around for decades, breakthroughs have meant it has become something of a buzzword, being awarded the latest Nobel Prize for physics, and increasingly being deployed in industrial production.”

"Laser technology exists today that can cut boron steel, but it is far too slow for any large scale production".

“By harnessing the unique characteristics of patent protected tapered double-clad fibre amplifiers power-scaled multichannel laser, the PULSE project will create unparalleled high-power beam qualities, M2<1.1, and pulse energies 2.5-250µJ.”

Positive Environmental Impact

The new system looks to have a positive environmental impact by being so efficient that waste products will be reduced.

“PULSE is committed to improving manufacturing, but also reducing the impact on the environment, therefore we can confirm that a 10% reduction in waste products is certainly achievable", Dr Gumenyuk said.

The laser system will enable an improved digital design to lighten vehicle chassis weight with benefits to fuel economy and increase the range of electric vehicles.

The consortium expects a prototype to be ready by 2021.

The PULSE consortium received a grant of € 5 206 207,50 from the EU via the H2020 programme and is made up of partners from six countries: United Kingdom (Aston University and Modus Research and Innovation Limited); Finland (AMPLICONYX OY); Germany (LUNOVU Gmbh and Hochschule Mittweida); Greece (Nanotypos OE, Foundation for Research and Technology HELLAS, and Prime Laser Technology Iliaka Systimata Thermansi Anonimi Viomichaniki Emporiki Etaireia); Italy (Centro Richerche Fiat SCPA and Onostampi SRL); Latvia (Ceram Optec Sia)

About Photonics21

Photonics21 is the European Technology Platform (ETP) for photonics, a technology encompassing all of the products and processes around the emission, manipulation and detection of light. Photonics is integral to a wide range of industries that include the medical, healthcare, transport, manufacturing, and telecommunications sectors.

"Photonics21" was set up in December 2005 to bring the community of photonics researchers and industries together. The European Commission defined photonics as one of five European Key Enabling Technologies (KET's) in September 2009. Shortly after, the European Research & Innovation Program "Horizon 2020" invited Photonics21 to become a "Public-Private Partnership" (PPP). The "Photonics 21 Association", a legal entity under Belgium law, became the private contract partner in November 2013 in a Public Private Partnership (PPP) in conjunction with the EU Commission.

Today Photonics21 represents more than 3000 personal members from across Europe and abroad.

Our members are experts in the photonics industry, research organisations and universities who actively engage with us to develop a joint photonics strategy for future research and innovation in Europe.

With the global photonics market growing from €350 Billion in 2011 to €447 Billion in 2015, Photonics remains a strong industry. The European photonics industry, estimated to be worth €70 billion, has considerable global leadership positions and employs over 300,000 people directly.

With positive growth forecast, current industry trends like digitalisation, resource efficiency, individual and zero failure production will drive the photonics industry further.

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