# LASER RESEARCH ASSISTS IN MANAGING STRESSES

## AN INTERVIEW WITH PRATIK SHUKLA

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### Q. Can you tell us about Coventry University?

I returned to Coventry University in 2017, having been an undergraduate and a postgraduate here over a decade ago. Coventry University has a long tradition of education (under different names) dating back to the Coventry College of Design which opened in 1843.

In the 1970s the institution became Lanchester Polytechnic, taking its name from Dr Frederick Lanchester, a famous automotive and aeronautical engineer who built cars in Coventry in the 1920s and 30s. In 1987, the name was changed to Coventry Polytechnic and then in 1992 it became Coventry University under UK Government legislation.

The logo of the university is the phoenix – a mythical bird with splendid plumage which is fabled to have lived in the Arabian Desert for five or six centuries and then burnt itself to death on a funeral pyre of aromatic twigs, ignited by the sun and fanned by its own wings. The phoenix rose from the ashes with renewed youth to live through another cycle.

This resonates with the city of Coventry, which rose from the ashes of heavy bombardment during the Second World War; the phoenix is a reminder of the city's resilience. Coventry University has adopted this symbol and takes pride in being associated with it.

## Q. How has Coventry University coped with the huge expansion over the past decade?

Overall, Coventry now has around 32,000 students and is the fastest growing university in the UK. As an undergraduate in 2001, I was one of just 25 students in Mechanical Engineering. Now we have 280 first years in the department. Since 2010, there has been a strategic increase in the student intake, particularly in engineering. In 2012, a new Engineering and Computing Building (ECB) was opened which was able to cope with the greater numbers and support the new investment in equipment and machinery. Now a second building (ECB-2) is under construction at a cost of £29 m, featuring a range of state-of-the-art facilities such as a gaming and virtual reality studio, rapid prototyping and 3-D printing, a laser facility and more.

> *"We need more development in sources and beam delivery for LSP."*

## Q. How is the UK university sector, and Coventry in particular, coping with current uncertainty in the UK?

For a few decades the EU has provided a collaborative framework in which British universities have grown and thrived. With the onset of Brexit, both the funds coming in and the student intake from Europe could be reduced. This may put many universities in a state of financial melt-down, whilst the stronger institutions will be able to find a solution in due course. I believe all universities will suffer from this - for example, partnering with UK university will become less favourable in comparison with an EU university. Hopefully, we can limit the damage from Brexit – which is the way forward for everyone in my opinion.

## Q. What are the main areas of laser processing research at Coventry?

We have greatly benefitted from a £700 K investment in laser-based facilities and analytical equipment. We have a range of lasers from high and low power continuous wave $CO_2$s, through to low, high and ultra-high energy Nd:YAGs in multi-wavelength, ns pulse regime, all the way to a large disc laser system and a new picosecond laser. Our major focus is on surface engineering applications, to enhance the functional properties of materials, with the most significant areas being Laser Shock Peening (LSP) and wettability. We conduct LSP on metals and other difficult-to-peen materials such as ceramics and composites, and then undertake detailed analysis to understand the laser-material interaction. We also study surface treatment of a wide range of materials for biomedical applications and other areas. In addition, we have a range of metal 3-D printing technologies and we are interested combining these with surface engineering for cleaning and peening applications. This capability builds on our stress analysis expertise and we are working closely with aerospace partners. Other areas we are working on include: cutting of polymers for automotive recycling; laser joining of polymer-based materials for food processing and other sectors; and improving the efficiency of laser based processes in general as well as laser beam characterisation.

## Q. What are the future prospects for Laser Shock Peening?

The application of LSP is growing, but the total installed base of systems is quite small as there are only a few suppliers and the laser system price is very high. We need more development in the sources and beam delivery to reduce the overall cost – in the same way as has happened in laser marking for example. When the price comes down, the number of industries using LSP will increase. We are working on technology to make the process more efficient with lower power sources – this is one step which should help the economic case to improve significantly.

## Q. What are the biggest challenges you face?

With new facilities being built in ECB-2 and the Institution of Advanced Manufacturing Engineering (AME-2), the future plans for our equipment and infrastructure look very secure, since new buildings are under construction with both lasers and characterisation equipment already purchased. The task for us now is to manage this, in order to establish a world-class laser processing facility. It is also challenging to be able to successfully recruit staff of the right training, experience and mind-set to carry out the work we are planning to do.

> *"The Laser User magazine enhances the impact of our research."*

## Q. What benefits has AILU membership given you?

As AILU members we have access to events which help us to keep up to-date with the latest in product and applications developments, as well as having access to the expertise of members. The Early Careers Researchers group is a useful recent networking initiative and Xioajun Shen, one of our PhD researchers is an active member of this group. We also find that The Laser User magazine enhances the impact of our research as it reaches the laser-based community more rapidly than journal papers. The format of the magazine articles is easy to read and directly becomes available to the right people in the laser community.

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