allied academies

International Conference on

Applied Physics & Laser, Optics and Photonics

April 15-16, 2019 | Frankfurt, Germany

## Improving laser powder bed fusion additive manufacturing by X-ray tomography

**Anton Du Plessis**[1], **Igor Yadroitsev**[2] and **Ina Yadroitsava**[2]
[1]Stellenbosch University, South Africa
[2]Central University of Technology, South Africa

Laser powder bed fusion (LPBF) is a form of additive manufacturing which allows detailed and complex functional components to be manufactured – recently in many new organic and biomimetic designs. This technology has the potential to disrupt the manufacturing industry through its freedom of design and new paradigm of complexity in parts that can be produced. Despite this potential, the processes need to be optimized to achieve acceptable mechanical properties and enhance the reliability of these types of parts. Using X-ray tomography to inspect final parts is one technique which has become almost routine in this industry – the non-destructive nature and the insights provided outweigh the costs involved. What is not well known yet – is that the laser powder bed fusion processes may be optimized using the technique in many other ways than simply inspecting the final part. The powder feedstock can be analyzed for sphericity, lack of porosity and lack of impurities. Small coupon samples can be analyzed for micro porosity distribution – this provides insight into defect formation regimes and can assist in optimizing the scan strategy, hatch spacing, contour scanning parameters or the laser power or scan speed, for example. Different regimes of process inaccuracy lead to different types, shapes and distributions of micro porosity, which is visualized by X-ray tomography. Finally, these distributions translate into the final complex parts which will be demonstrated. Finally, small coupon samples called witness specimens are built alongside the complex part and are used as reference for analysing the micro porosity and defects formed during the process – for example for layered stop-start flaws. Examples of all of these will be discussed in the presentation, in the context of improving and refining additive manufacturing processes.

**e**: anton2@sun.ac.za

*Notes:*