OPTICS & PHOTONICS
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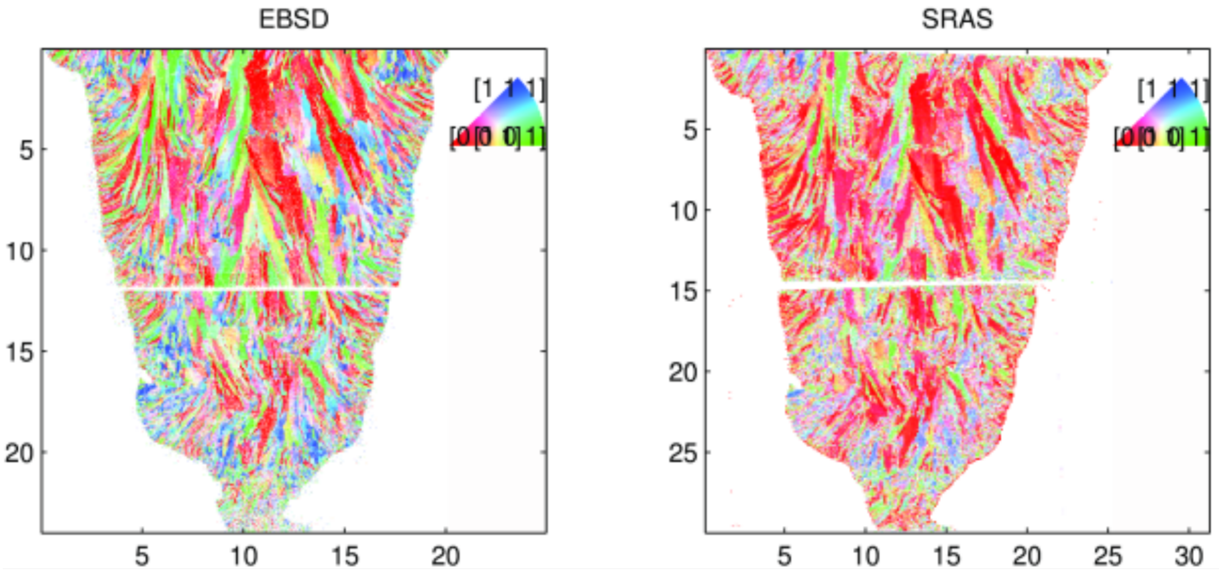
Optics and Photonics Group Lunchtime Seminar

"Spatially resolved acoustic spectroscopy (SRAS): an NDE technique for materials characterisation based on laser ultrasonics"

Wenqi Li



1:00pm Wednesday 5th June 2019
203 Tower building
All Welcome

http://optics.nottingham.ac.uk/wiki/Talks_2019

Abstract

“Spatially resolved acoustic spectroscopy (SRAS): an NDE technique for materials characterisation based on laser ultrasonics”

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Material characteristics such as strength, stiffness and fracture resistance are strongly related to the underlying microstructure. In order to predict the mechanical behaviour of industrial materials such as titanium, nickel and their alloys – made by conventional techniques or additive manufacturing – detailed knowledge about their texture is required. A robust measurement tool is introduced which can be used to determine texture, grain orientation and surface and sub-surface defects of a material. This is achieved by using a laser ultrasonic technique known as spatially resolved acoustic spectroscopy (SRAS). In SRAS, a SAW excitation pattern is generated by projecting a grating pattern of laser light. By using a broadband laser in combination with a fixed grating, the local velocity v can be calculated, through $v = f\lambda$, where f is the frequency of the detected signal and λ is the grating period.

The velocity map measured by SRAS reveals the grain size and texture of a material. For crystallographic orientation determination, a SAW velocity model is calculated from the material's elastic constants and mass density; a search algorithm termed the overlap function is used to compare the SRAS data to the model to determine the crystallographic orientation. Beside the above, surface, sub-surface defects and other information also can be extracted from the SAW velocity. We examined a range of materials commonly used for industry. Comparisons between SRAS and other techniques including electron backscattered diffraction and X-ray diffraction are presented. This is an innovative and all-purpose NDT technique for materials manufacture monitoring and quality control.