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Original Citation

Tang, Dawei, Gao, F. and Jiang, Xiang (2014) White Light Channeled Spectrum Interferometry for the On-line Surface Inspection. In: The 3rd Annual EPSRC Manufacturing the Future Conference, 23 Sep-24 Sep 2014, Glasgow Science Centre, Glasgow, UK. (Unpublished)

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White Light Channeled Spectrum Interferometry

for the On-line Surface Inspection

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Aim

This research project aims to explore an environmentally robust surface measurement system for on-line surface inspection by using cylindrical lenses based **White Light Channeled Spectrum Interferometry** (WLCSI) , and to realize large dynamic measurement ratio with a high signal-to-noise ratio.

Introduction

The rapidly developing industries such as MEMS, micro fluidics, photovoltaic thin film, Si wafers and hard disks critically rely on micro/nano scale and ultra-precision structured surfaces.

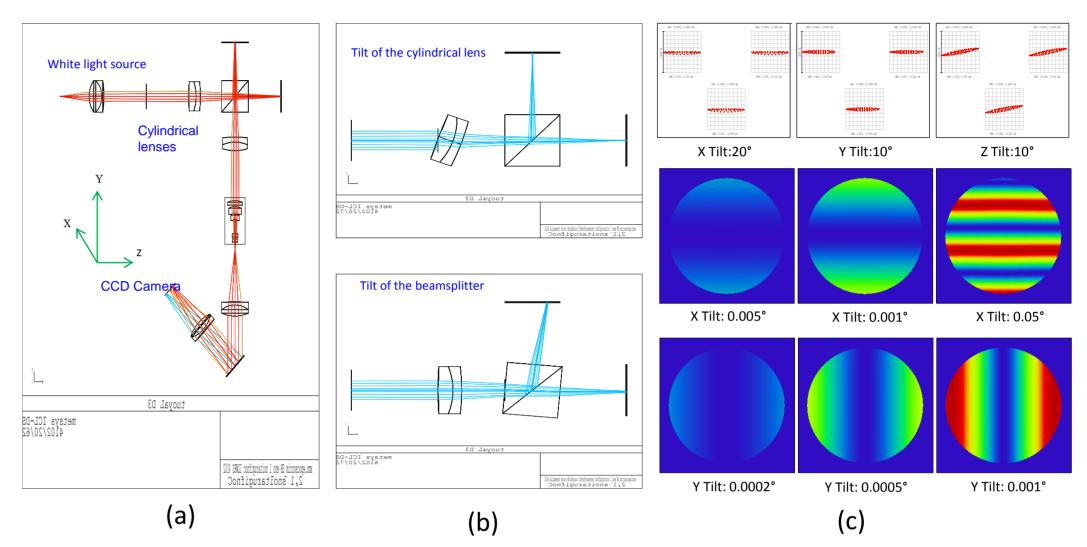
The proposed WLCSI in this research project is effective for applications in on-line surface inspection because it can obtain a surface profile in a single shot. It has an advantage over existing spectral interferometry techniques by using cylindrical lenses as the objective lens in a Michelson interferometric configuration to enable the measurement of long profiles.

Optical simulation

The WLCSI was modeled using Zemax software to get better understand the influence from the alignment errors.

- □ Tilts of cylindrical lens (CY) only lead to the deformation of the line focusing beam on the tested surface.
- Tilts of the beamsplitter (BS) will lead to a tilt of the optical axis and thus the light beam will no longer travel on the same path, which in this case straight fringes with equal interval are generated on the image plane.

BS is much more sensitive to the tilt than CY.



Experimental setup

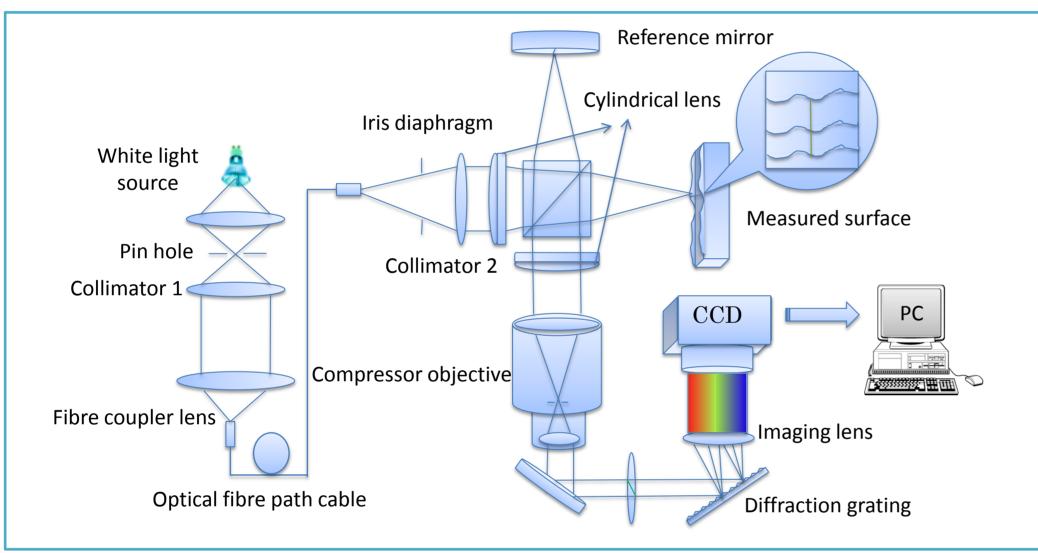


Fig. 1. Schematic diagram of WLCSI

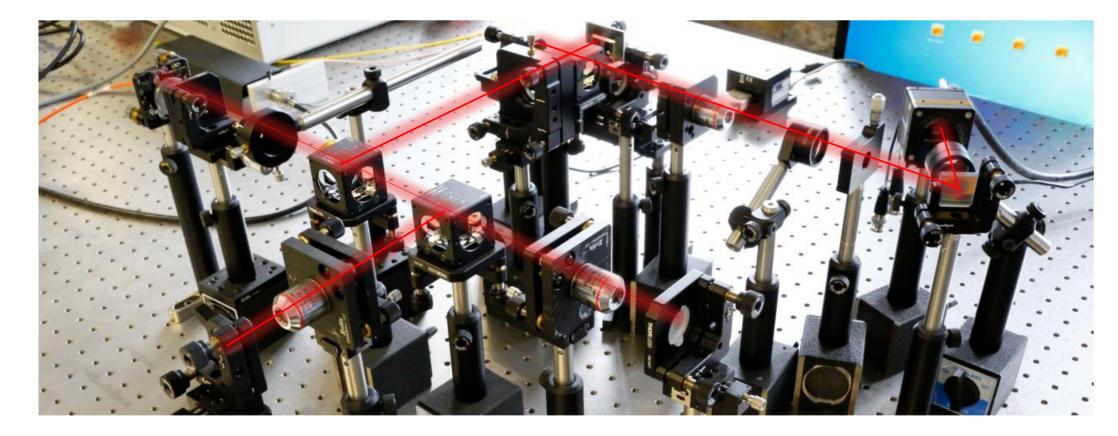


Fig. 4. Simulation results: (a) 3D layout, (b) misalignment—tilt, (c) spot diagram and interferograms resulting from alignment error

Measurement results

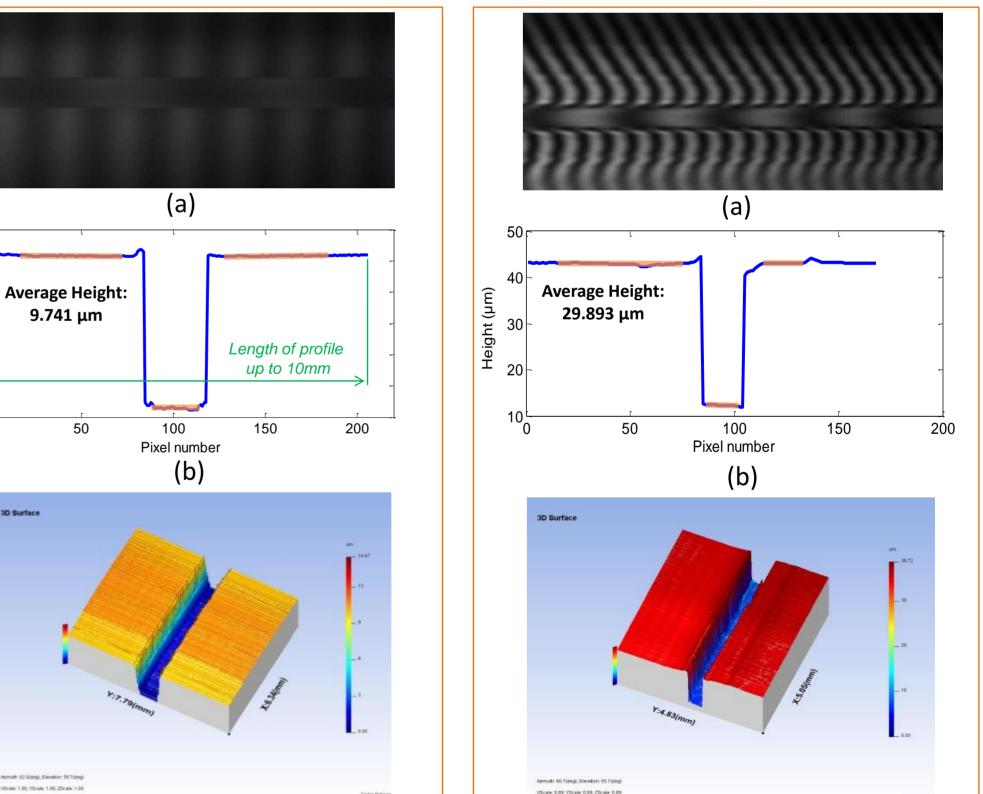


Fig. 2. Experimental optical setup

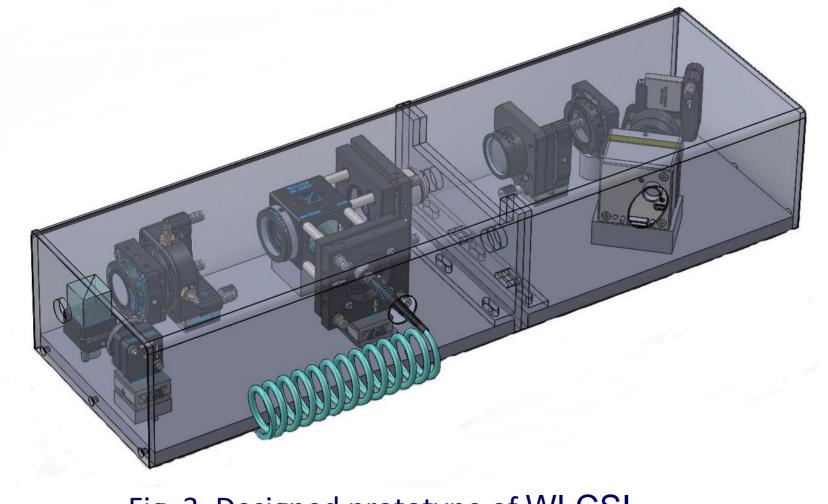


Fig. 3. Designed prototype of WLCSI

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(c)		(c)	

Fig. 5. Measurement results of 9.759 μm and 30 μm step heights :(a) captured interferogram, (b) 2D profile result, (c) 3D surface map

Conclusion

ight (µm)

The performance of the proposed WLCSI was evaluated by measuring two step samples. Both 2D profile results and 3D surface maps closely align with the calibrated specifications given by the manufacturers, which verifies our setup is effective for applications like the R2R surface inspection, where only defects on the film surface are concerned in terms of the quality control.

The authors gratefully acknowledge the UK's Engineering and Physical Sciences Research Council (EPSRC) funding of the First Grant (Grant Ref: EP/K007068/1), the funding of EPSRC Centre for Innovative Manufacturing in Advanced Metrology (Grant Ref: EP/I033424/1) and the funding with Grant Ref: EP/K018345/1. Feng Gao gratefully acknowledge the EPSRC High Value Manufacturing Catapult Felloships.