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Structured Surfaces, Measurements & Characterization

Original Citation

Wang, Jian, Jiang, Xiang, Blunt, Liam and Leach, Richard K. (2009) Structured Surfaces, Measurements & Characterization. In: University of Huddersfield Research Festival, 23rd March -2nd April 2009, University of Huddersfield. (Unpublished)

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STRUCTURED SURFACES, MEASUREMENT & CHARACTERIZATION Author: J. Wang, X. Jiang, L. Blunt, R. Leach

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Introduction

The most important physical phenomena involving exchange of energy and/or signal transmission take place on surfaces. And surface topography or texture play a very important role in functional performance, like wetting, reflection, etc, as in Table 1 and the gutter. "Structured surfaces" which is defined as the surface where deterministic patterned geometric features dominate, as a novel branch of functional surfaces, is emerging.

Problems

& Aims

In manufacture of structured surfaces, evaluation (measurement and characterization) is essential. But because of their special topography.

- 1. High aspect ratios
- High slopes
- 3D nature with re-entrances
- 4. Very fine topographic scale but with very large scaled covering area

Barriers are encountered in measurement using process Besides, instruments. conventional characterization conventional methods, like Sa, work in vain for structured surfaces.

sampling New measuring, and characterization methods are in need.

Table 1 Applications of structured surfaces

Principles	Function	Examples
classification	details	
Optics	Geometric	Fresnel lens
	optics	
	Reflectivity	High reflective
		anti-reflective
	Diffractive	Diffractive gra
	optics & micro	Lens arrays
	optics	
Mechanics	Tools	Micro tools
		Abrasive pape
	Tribology	High stiction s
	(friction, wear,	Friction contro
	stiction)	Hard disk surfa
	Hydro-	Golf balls
	dynamics	Herringbone t
	Machinery	MEMS
		Macro mechan
	Surface energy	Adhesion
		De-wetting an
	Metrology	Metrology arte
	Others	Vacuum chunk
Biomedicine	Medical	Artificial hip a
	implant	Dental implan
		Blood contact
	Medical	Lab-on-a-chip
	diagnostics	μTAS
	Bioelectronics	Bio-electronic
	Biomimetics	Structural cold
Thermo-		Spray cooling
dynamics		Boiling
Informatics		Information st
Electronics		ICs

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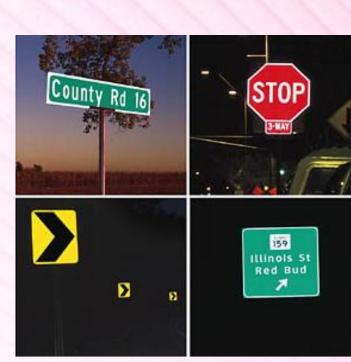
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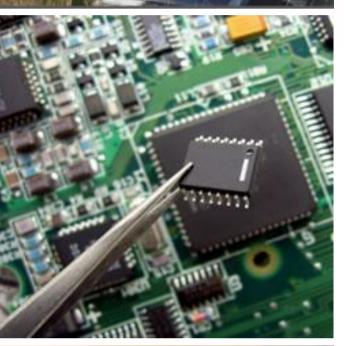
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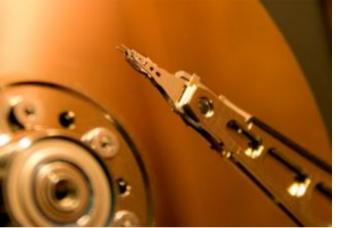
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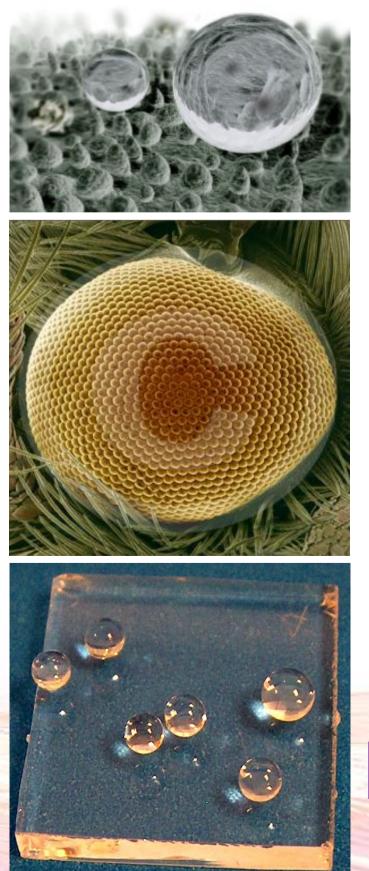












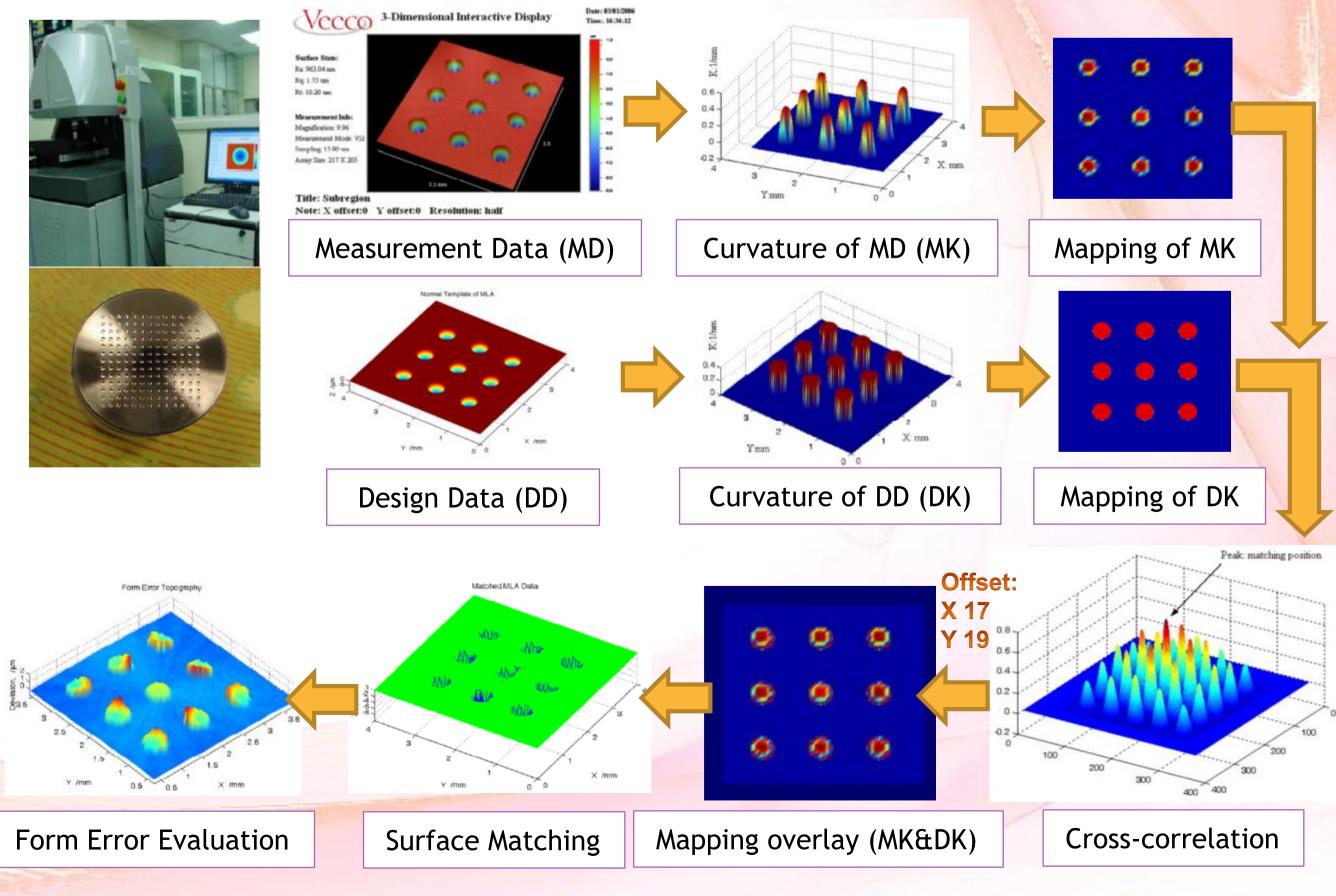


Generic measurement tasks to be performed in structured surfaces are:

- Distance
- Width
- Height
- Geometry
- Texture and roughness
- 6. Thickness of layer
- 7. Aspect ratio
- 8. *Slope*
- 9. Angle
- 10. Edge radius
- 11. Defects area
- etc. (Figure 1)

Measurement

Characterization of structured surfaces differs from the conventional methods, which is deterministic, and may be periodic, or rotational symmetric.





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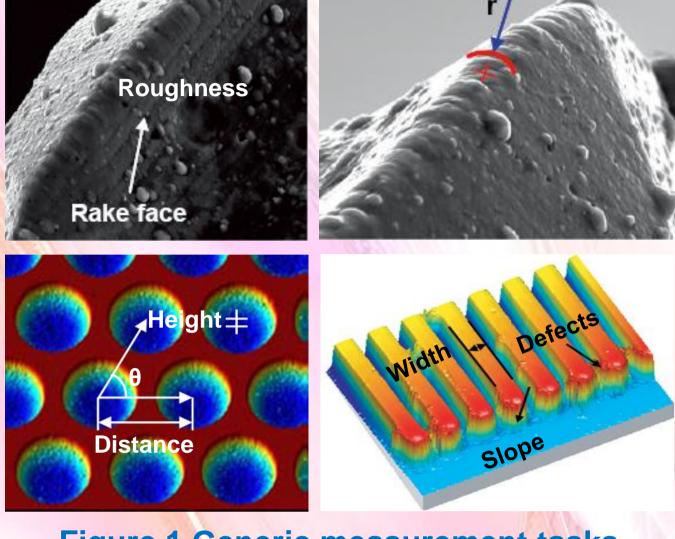


Figure 1 Generic measurement tasks

Characterization

Feature parameters extraction based on signal process is in standardization. A general method named as "Surface intrinsic feature based method" (SIFM) is shown in Figure 2.

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