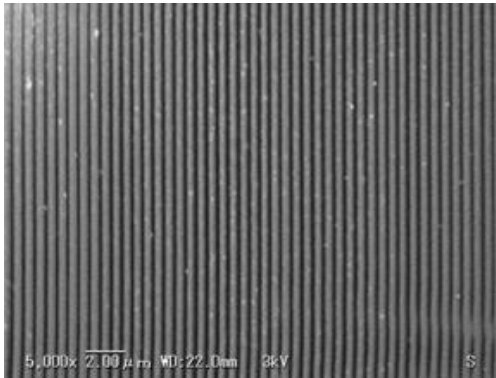


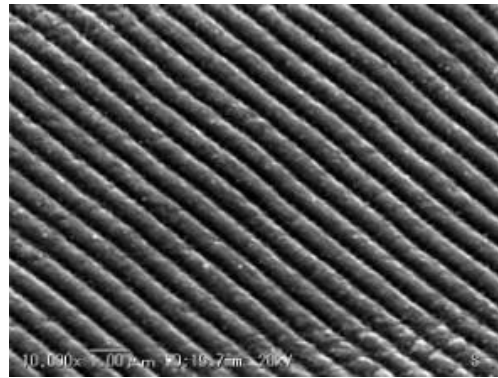
Ultrashort Pulse Laser Processing Technology Microstructure Formation with the Surfbeat R

SEM images of a Si wafer and carbon chrome steel are introduced as an example of formation of nano-sized ripple structures. The basic function of the Surfbeat R is to form grating-like fine periodic structures with a period interval of about the irradiated laser wavelength and a height of up to around 200 nm at high speeds on material surface including metal, semiconductors and ceramics.

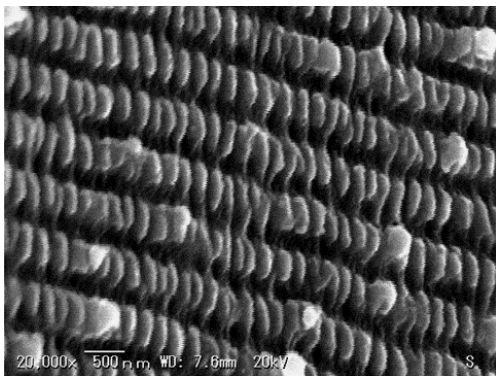
Typically, it can produce two million ripple structures per second with a track width of 4 mm. By scanning the laser focal spot, it is also possible to form fine periodic structures, which directionality is controllable, in any region of material surface. Regarding thermal effects in the machining area, by minimal thermal process of ultrashort pulse laser and a required minimum energy injection, material characteristics and dimensional accuracy are essentially preserved.



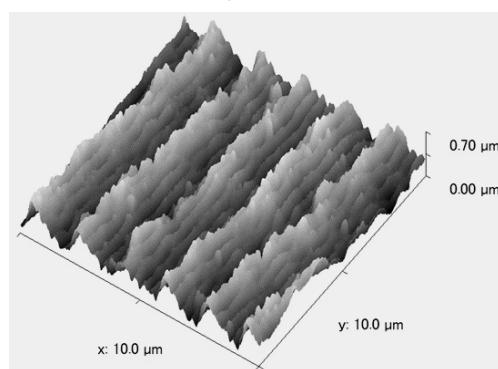
Fine periodic structures formed on Si wafer
Period = 800 nm Height = 50 nm



Fine periodic structures formed on carbon chromium steel
Period = 800 nm Height = 150 nm



Fine periodic structures formed by two scans.
Different laser wavelengths were used in each scan.



Fine periodic structures in which $\lambda/(1 + \sin \theta)$ and $\lambda/(1 - \sin \theta)$ intervals are simultaneously formed by oblique incidence

Surfbeat R Processing Mode

The Surfbeat R offers a selection of two processing modes, “standard mode” and “high speed mode,” depending on the processing area and shape of the work piece.

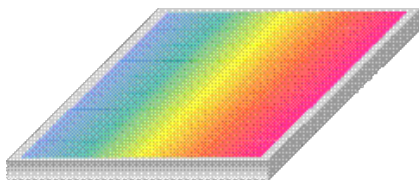
In the processing demonstration introduced here, three ring-shaped areas are treated. In the first and the second circuits, the processing examples have a 4 mm band track width and 4 mm/s peripheral speed in “standard mode”. Since fine periodic structures with different angles were formed by polarization control between the first track and the second, diffracted light look different.

Finally, the center spiral to be machined is an example of processing with a track width of 40 μm and a peripheral speed of 100 mm/s in “high speed mode”. This mode is effective when the treated area is small or partial.

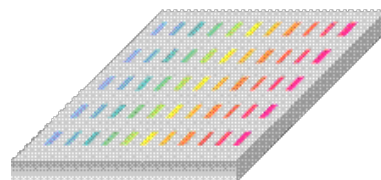


Optional Texture Formation Function

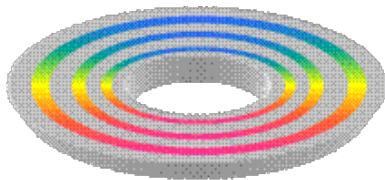
The Surfbeat R can accurately control the number of irradiation pulses of ultrashort pulse laser on a single shot basis. With this function, it is possible to create a texture pattern in which the composition ratio of fine periodic structures and the bulk surface on material surface is freely controlled. In addition, texturing combinations of a fine periodic structure, trenches and dimples is also possible.



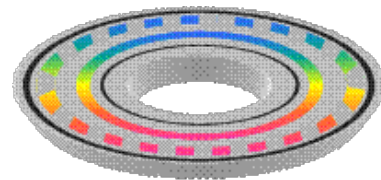
Fine periodic structures formed on entire surface



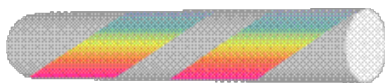
Fine periodic structures of intermittent patterns



Concentric fine periodic structures



Complex patterns of fine periodic structures and grooves

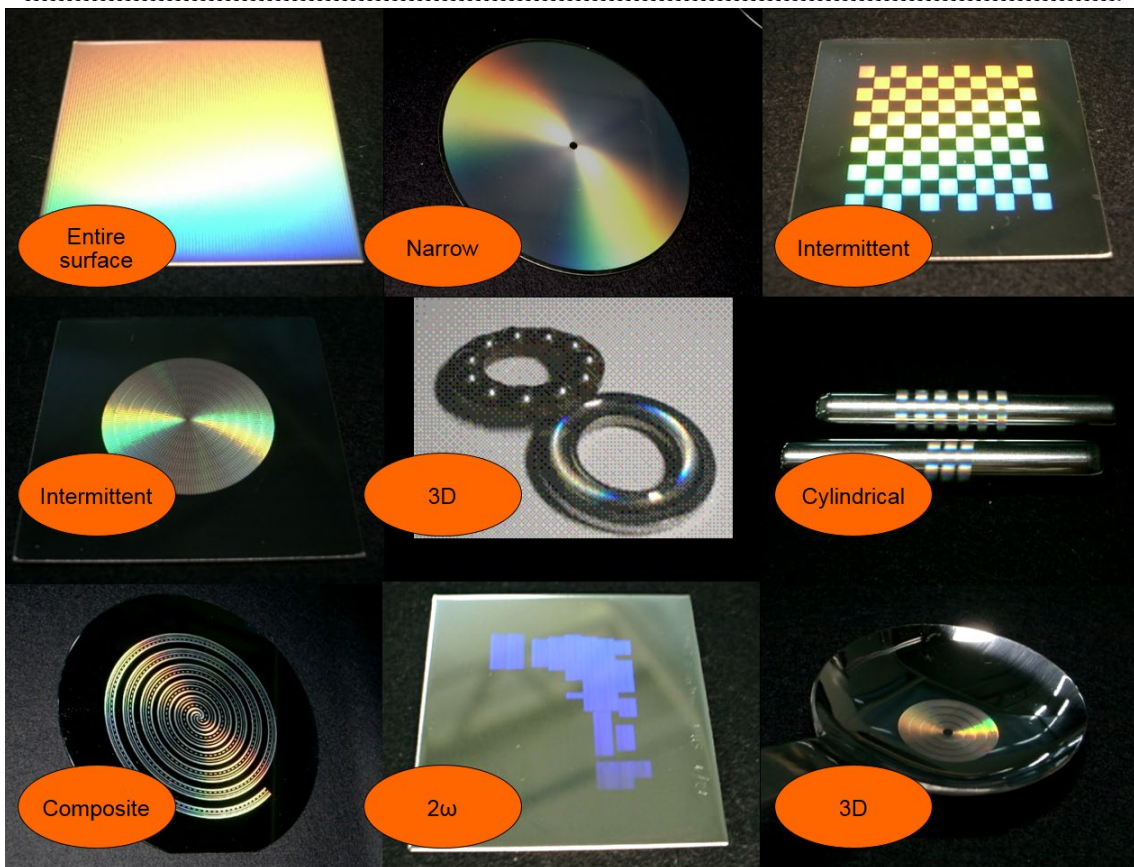
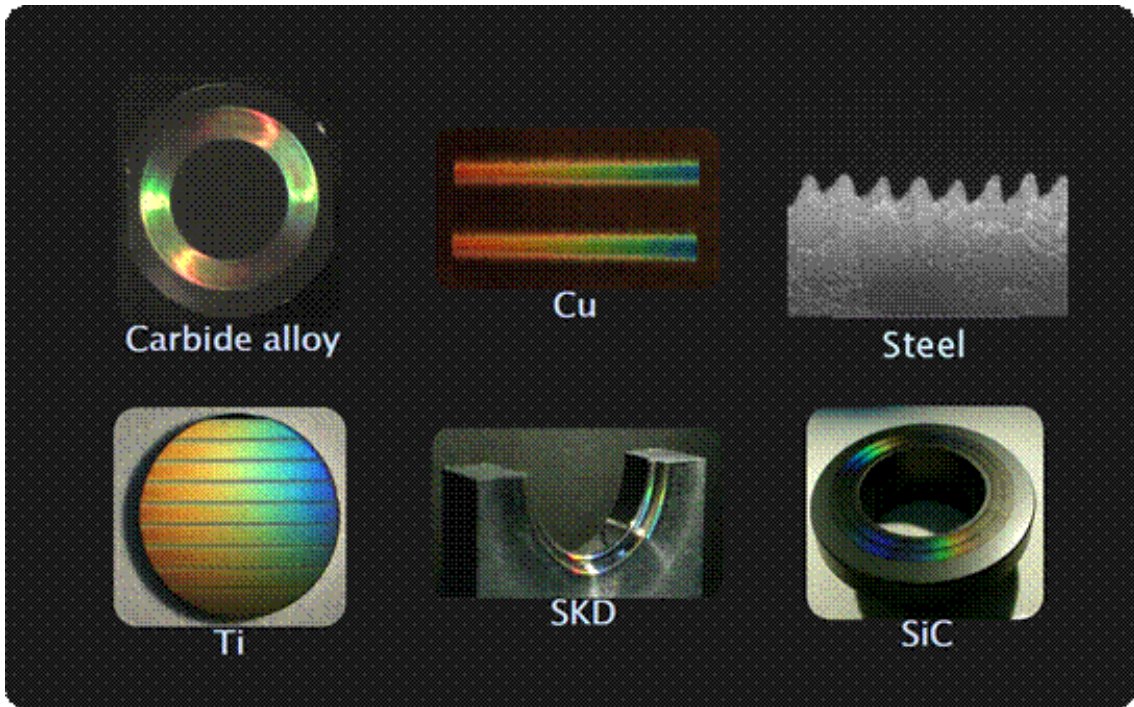


Spiral fine periodic structures



Ring-shaped parallel grooves

Texture Processing Examples



Main applications

- Reduction of friction loss of precision sliding parts
- Improvement of coating film adhesion
- Prevention of particle adhesion and control of wettability

Surfbeat R Features

Without degrading dimensional accuracy and material properties of a work piece, it can create functional surfaces on any area without contact. Special environments are not required for surface texturing. In addition, the unit design allows the flexible expansion of optional functions such as wavelength conversion, double pulse exposure and processing with an objective lens.

The individual operation switches help you achieve easy and smart work handling and optical system control. Basic texture processing can be achieved by a simple operation.

You can produce optimized textures with free combination of fine periodic structure, dimples, trenches, etc. via a simple operation. A wizard function enables the easy creation of processing recipes. Even without your experience of ultrashort pulse lasers usage and microfabrication, the Surfbeat R's precision and operability accurately reflect your ideas freely on work surface patterns.



Ultrashort Pulse Laser Light Source

The standard edition of the Surfbeat R carries the TRUMPF TruMicro series, which gives you a high-quality beam and long-term stability for industrial use. A custom version is also available.

Contact Us

The Surfbeat R is located at our headquarters.

Please contact us if you have an interest in these products.

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