Shifted laser surface texturing

Development status

Phase 3

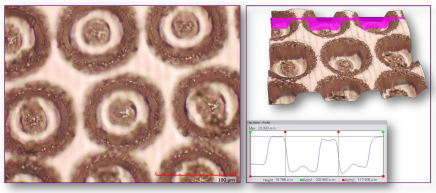
Technology validation and implementing it in real environment. Testing the technology outside of the laboratory and its adjustment to external conditions.

IP protection status

Patent

Partnering strategy

Collaboration, licensing



Institution

ZÁPADOČESKÁ UNIVERZITA V PLZNI

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Challenge

Laser surface texturing is a promising technology for a future broad application on functional surfaces with specific properties, e.g. surfaces that are hydrophobic/hydrophilic, antibacterial, anti-stick/adhesive, self-cleaning, anticorrosive, light absorbing, with low friction, etc. Remarkable progress has been made in recent years, yet in most cases, it takes from several minutes to one hour to create one square centimetre of a functional surface. Despite the availability in recent years of high-performance pulse lasers, productivity has not increased dramatically, as there are physical limitations to current processing methods: accumulation of heat and oxidation, plasma shielding, and accuracy in high speeds. In order to address these limitations, a new method, called shifted laser texturing (sLST), has been developed. The new method has the potential to be at least 100 times more productive and free of heat accumulation effects.

Description

The shifted Laser Surface Texturing (sLST) method was developed at NTC as a method of drilling large numbers of small objects on a surface or in a volume of a material. This method can be used for the effective creation of functional surfaces (e.g. hydrophobic, friction-reducing, antibacterial, light-absorbing, or adhesion-enhancing). Functional surfaces are often composed of periodically repeating structures (objects). In shifted laser surface texturing, the total number of objects is produced by repetitive rapid motion of the laser, line by line (following a raster); the laser pulses are spread quickly across the entire surface of the object - one pulse per object at a time. In each following step, the process is repeated with the raster shifted by a small distance, corresponding to the desired distance of the laser pulses in the object. Objects represent removed area of a surface of a particular size and shape (dimple, column, donut). A large structure may have hundreds of thousands or millions of objects. The sLST method eliminates the unwanted effect of heat accumulation and minimizes the plasma shielding effect of the laser, while at the same time allows for efficient use of high average power in pulsed lasers. This makes the laser texturing manufacturing process considerably faster - up to 100x. Another advantage is precise texturing geometry maintained also at high laser scanning speeds.

Commercial opportunity

The presented invention of shifted laser texturing is an expedient method for the rapid, accurate and efficient repetitive generation of a large number of micro-objects on a material surface using short and ultrashort laser pulses. The sLST method is especially suitable for combining with hybrid polygonal laser beam scanning systems where a linear raster is created by a polygonal mirror and gradual raster shifts are controlled by the galvanometric part of the scanning head. The shifted LST method processing algorithm can be additionally included in the existing software library (featuring LaserDesk, SAMLight, Lighter,and Trumpf); alternatively, specialized software can be written to be used specifically with the shifted LST method. This method can be used for the effective creation of functional surfaces, including, for example, tribological, light-absorbing, adhesion-enhancing, hydrophobic, or antibacterial ones.