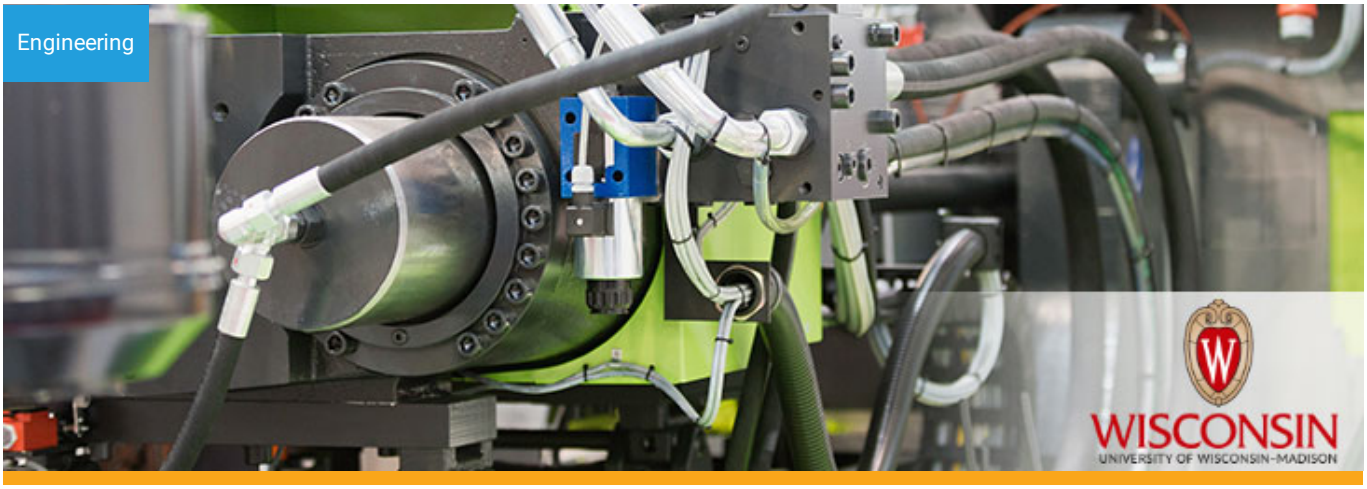
Engineering



Smoother Surfaces with Pulsed Laser Polishing

View U.S. Patent No. 10,315,275 in PDF format.

WARF: P130168US01

Inventors: Frank Pfefferkorn, Xiaochun Li, Neil Duffie, Chao Ma, Venkata Madhukanth Vadali

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a laser polishing technique that varies operating conditions between passes.

Overview

Pulsed laser polishing (PLP) helps smooth metal and other material. The technique employs lasers to irradiate a surface, melting small areas with each pulse. In these molten areas, rough surface protrusions, or asperities, are 'pulled down' by surface tension. If this happens before the melt resolidifies, the resulting surface is smoother.

While PLP provides better heat and melt control than other approaches, such as continuous wave (CW) laser polishing, large surface asperities can persist. The method must be improved, especially in the context of microscale devices.

The Invention

UW–Madison researchers have developed a two-regime method to reduce rough surface features using a multiple-pass PLP approach.

In the first regime, melt pools are created on the surface using energy pulses, which generate higher temperatures where the beam is focused. Thermocapillary flow pulls down asperities into the melt pools. This can cause material to push up at the edge of the pools as they resolidify. A second regime applies different energy pulses to remove and/or rearrange the upwelled material.

Applications

- Polishing metallic parts
- Creating mirror finishes
- Microfabricated and micromanufactured parts, particularly for biomedical applications
- Useful for tool and die makers, including plastic injection molders and optical part manufacturers

Key Benefits

- Smoother surfaces
- No debris
- No change in the dimensional form
- Much easier to polish features with tight dimensional tolerances
- Enables very fast selective polishing
- Can polish microscale features and parts
- Reduces height of high- and low-frequency surface asperities

Stage of Development

Experimental results on micro end-milled titanium indicate greater than 70 percent improvement in surface finish can be achieved.

Additional Information

Related Technologies

- WARF reference number P06146US describes a method of applying nanocrystalline diamond coatings capable of improving the performance of microcutting tools.

Tech Fields

- Engineering : Micro & nanotechnologies

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867