Exploring Convergence of Snake Skin-Inspired Texture Designs and Additive Manufacturing for Mechanical Traction

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Background/Relevance

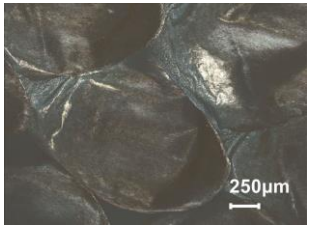
- Textures in nature can be exploited to benefit industrial applications.
- Surfaces interact with aggressive environmental factors.
- Snake scales are composed of micro-denticulations and rough edges which allow the snake to grip the ground.

Innovation

- To take examples of the textures found on snake skin and write similar textures derived from that architecture. Analyze laser processed surfaces for microstructural and chemical modifications.

Approach

- Use of a laser-powder bed fusion process to write architecture of the scales that form snake skin.
- Laser microfabrication allows for complex patterns to be written.
- 3D written microstructures are chemically and physically analyzed.
- Will implement patterns onto metals to test their frictional parameters.



Key Results

- Studied snakes skin using profilometer and identified the major advantages to the structure.
- Designed and 3D printed our own “skin”.
- Tested the anisotropic frictional properties due to the laser patterning and compared to real snake skin.

Conclusions

- Observed a periodic increase and decrease following micropattern’s periodicity.
- This demonstrates that snake-skin micro texture could control traction at microscale by periodic modulation of micro frictional properties of 3D printed material.
- Larger scales and smaller scales were tested to prove that the anisotropy is present due to the micro patterning and not the size of the overall scale.
- Overall, a snake skin-insprired 3D texture was successfully manufactured and showed clear anisotropic frictional properties.