Hybrid machining of Ceramic: Combination sequential milling and laser machining

Introduction
The demand for micro products has increased gradually since last decades in various areas, requiring the development of micro manufacturing processes. Micro manufacturing is characterized by the size of functional features (less than 10 mm), a high precision, a good surface finishing and complex parts in a wide variety of materials. Hybrid Machining Processes (HMPs) were introduced to address the demand to increase production with an enhanced quality for difficult-to-machine materials such as ceramics. The final goal is to determine an optimal combination with the laser source and one tool geometry.

The first step is to master each process. Indeed, the milling of green body is difficult because of tool contact and the laser machining because of heat transfer. Moreover, the position tool should be to control for HMPs.

Experimental method
Microfluidic device
Structure hight: 500 μm
Wall thickness: 200 μm
Material
Y-TZP Ceramic
Green body

Milling
- Parameters determination
  - Based on coupling tool-material
  - Test of thin-walled

Laser Machining
- Parameters determination
  - Based on experimental design 2^4
- Test of thin-walled

Combination

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Conclusion
- Default in the tool position
- Thin-walled in laser << Thin-walled in milling

Perspectives
- Development an other method for milling parameters
- Sequence optimisation