Designing a Tool System for Lowering Friction during the Ejection of In-Die Sintered Micro Gears - DTU Orbit (07/12/2018)

Designing a Tool System for Lowering Friction during the Ejection of In-Die Sintered Micro Gears

The continuous improvements in micro-forging technologies generally involve process, material, and tool design. The field assisted sintering technique (FAST) is a process that makes possible the manufacture of near-net-shape components in a closed-die setup. However, the final part quality is affected by the influence of friction during the ejection phase, caused by radial expansion of the compacted and sintered powder. This paper presents the development of a pre-stressed tool system for the manufacture of micro gears made of aluminum. By using the hot isostatic pressing (HIP) sintering process and different combinations of process parameters, the designed tool system was compared to a similar tool system designed without a pre-stressing strategy. The comparison between the two tool systems was based on the ejection force and part fidelity. The ejection force was measured during the tests, while the part fidelity was documented using an optical microscope and computed tomography in order to obtain a multi-scale characterization. The results showed that the use of pre-stress reduced the porosity in the gear by 40% and improved the dimensional fidelity by more than 75% compared to gears produced without pre-stress.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Electrical Engineering, Automation and Control
Contributors: Cannella, E., Nielsen, E. K., Stolfi, A.
Number of pages: 15
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Micromachines
Volume: 8
Issue number: 7
Article number: 214
ISSN (Print): 2072-666X
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 2.31 SJR 0.493 SNIP 0.987
Web of Science (2017): Impact factor 2.222
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 1.83 SJR 0.395 SNIP 0.791
Web of Science (2016): Impact factor 1.833
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 1.78 SJR 0.463 SNIP 0.925
Web of Science (2015): Impact factor 1.295
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 2.1 SJR 0.625 SNIP 1.341
Web of Science (2014): Impact factor 1.269
Scopus rating (2013): CiteScore 1.73 SJR 0.479 SNIP 1.107
Web of Science (2013): Impact factor 1.286
ISI indexed (2013): ISI indexed no
Scopus rating (2012): CiteScore 1.28 SJR 0.472 SNIP 1.285
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.222 SNIP 0.882
ISI indexed (2011): ISI indexed no
Original language: English
Keywords: Micro sintering, Field assisted sintering technique, Hot isostatic pressing, Micro gears, Computed tomography, Dimensional accuracy, Porosity analysis
Electronic versions:
micromachines_08_00214.pdf
DOIs:
10.3390/mi8070214
Research output: Research - peer-review ; Journal article – Annual report year: 2017