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A new thin film printing process for direct metal deposition for MEMS applications using the novel atmospheric pressure sputtering technology

Jan Bickel[1], Ha Duong Ngo[1], Martin Schneider-Ramelow[2], Klaus Dieter Lang[2], Joachim Scherer[3], Roland Gesche[4]

[1]HTW - Berlin, Berlin, Germany [2]Fraunhofer IZM, Berlin, Germany [3]Aurion, Seligenstadt, Germany [4]Beaplas, Berlin, Germany

jan.bickel@htw-berlin.de

Additive manufacturing methods, such as direct metal deposition, are becoming increasingly important. Spraying technologies such as thermal or plasma spraying [1], but also laser cladding or laser metal deposition (LMD) [2] [3] play a central role for additive metal direct deposition. However, these spraying technologies itself are not suitable for the field of micro structuring. At the other side specific direct metal deposition technologies are more and more used for MEMS production. The inkjet and aerosol printing processes are particularly noteworthy here. The printing of nanoparticles is progressively applied to produce electrical leads and contacts on the desired surfaces. Both processes work with prepared nanoparticles that are generated from a dispersion or an aerosol from a dispersion. [4] [5] However, these established technologies have some disadvantages, as handling and cost-efficiency. In this paper a new production process is presented, which uses the novel technology of atmospheric pressure sputtering [6] [7] to apply directly metallic conductors onto three-dimensional substrate surfaces. It is based on thin film direct coating of gold and platinum for high temperature interconnection technology. Other process able materials are palladium and silver. The advantages of this new production process compared to similar conventional technologies will be explained. These advantages are for instance lower raw material consumption, lower technology costs, higher electrical conductivity and a higher flexibility of production. Furthermore, layer thicknesses below 100 nm and above 10 µm can be realized with this new technology. Maximum static deposition rate of the standard material gold depends on the final layer porosity and lies between 500 nm/s for 90% and 50 nm/s for less than 1% porosity. Limitations are until today, the structural widths of at least 700 µm. The reasons for this characteristics and how it may can be improved in the future will be also explained in this paper.

Keywords
Additive Manufacturing
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