



GOLD 2006

New Industrial
Applications for Gold

TECHNOLOGY EXCHANGE

Title: Electrostatic Atomization Printing of Gold

Type of Opportunity (eg collaboration or licensing opportunity): Collaboration or Licensing

Background:

Electrostatic Atomization Printing is a patterning technique which functions in conjunction with electrohydrodynamic forces to create high resolution architectures containing nano particles. Electrohydrodynamic atomization is novel and a cost effective processing technology in which a suspension is released at a controlled flow rate through a fine needle ($< 1\text{mm}$ in diameter) exposed to an electric field and the resulting jet disintegrates into fine droplets. The flow of the suspension beneath the needle takes many shapes or forms known as modes of atomization. Spindle, cone-jet, multijet are some of the many modes, which occurs depending on the electrode configuration, properties of the liquid, the flow rate of the liquid and the applied voltage. The most interesting mode is known as "cone-jet" mode. The cone-jet mode is where a cone forms at the exit of the needle and a jet evolves from the cone apex and later propagates into a spray. This mode is more desirable as it is known to produce near mono-dispersion of droplets.

The patterning device consists of an X–Y stepper motor driven 2-axis system. The X and Y tables are mounted directly on one another keeping the 2-axis profile very low. A datum and an end of travel limit sensor are fitted on each of the tables to trigger the controller when a respective carriage reaches a limit. The 2-axis system is PC-controlled using a programmable motion controller. A Perspex table is mounted firmly on the 2-axis system. The top of the table accommodates a frame for holding firmly upto an A4 sheet of substrate. Using Motion Planner software, geometry can be created using X and Y co-ordinates and downloaded to the 2-axis controller, allowing the 2-axis system to follow the path of the co-ordinates given, to enable patterning. In this way, we have been able to deposit nano-gold particles into pre-determined arrays. **See our paper in the Gold Bulletin June 2006.**

Key Benefits:

- Nozzles used in electrostatic atomization can be several hundred micrometers in size and this is almost ten times bigger than those used in ink-jet printing. The use of large nozzles prevents blockages and allows easier processing of viscous ceramic suspensions containing a high level of solid and/or fast evaporating liquids.
- Despite the use of much coarser nozzles, the droplet sizes generated are much finer, usually by an order of magnitude compared with ink-jet printing.
- Economically more feasible.

Application Areas:

- In biomaterials – Can be used for tissue engineering, create surface topography on implants, fabricate implants and insert and deposit cells.
- In Functional materials – Can be used to fabricate micro channels, arrays, micro chips, conductive tracks...etc.
- In Structural materials – Fabricate micro/nano composites, designing different composites with multi layer structures and surface patterning.

Patent Status: Not Relevant

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