# LASER DIRECT WRITING PROCESS

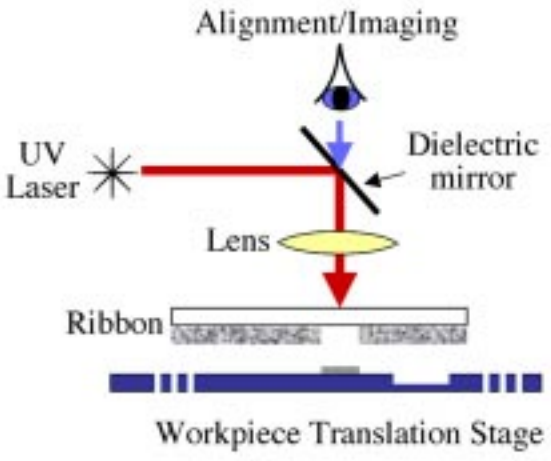


**Figure 1**

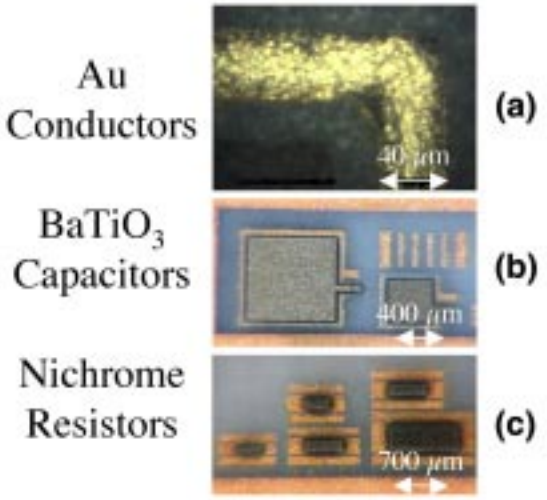


**Figure 2**

The Naval Research Laboratory has developed a novel laser-based approach to direct writing microelectronic devices and chemical sensors. The technique is known as Matrix Assisted Pulsed Laser Evaporation Direct Write (MAPLE DW). As shown in Figure 1, a focused pulsed laser beam passes through a ribbon support and interacts with a coating consisting of the compound to be deposited dissolved in a solvent. Upon laser irradiation, the ribbon coating decomposes into a harmless volatile gas and the solute, which is deposited as a dense, adherent film. The MAPLE DW process has advantages over existing techniques, including the following:

- Allows deposition under ambient conditions (in air and at room temperature).
- Allows deposition of a wide range of materials, including metals, oxide ceramics, polymers, and polymer composites.
- Electronic properties of deposits are comparable or better than similar structures fabricated using other direct-write techniques.
- Capable of write speeds approaching 1 m/sec with <10 mm resolution.
- "Ribbons" can be easily interchanged to allow deposition of different materials.
- Sample can be visually inspected *in situ.*

MAPLE DW has also been used to direct-write films for high-gain antennae, chemical sensors, and conformal batteries. Furthermore, when the ribbon is removed, the MAPLE DW tool can be used for conventional laser processes such as cleaning and/or micromachining substrate surfaces or previously deposited materials.

- Drilling vias between different layers.
- Trimming components *in situ.*
- Laser annealing of surfaces.

Shown in Figure 2 at the top right are examples of gold electrodes prepared using MAPLE DW by deposition (a) and removal of surrounding material (b and c). The barium titanate capacitors (b) and Nichrome alloy resistors (c) were also deposited by MAPLE DW process with automated computer-control of the sample position during deposition.

*Points of Contact*

Naval Research Laboratory
4555 Overlook Avenue, SW • Washington, DC 20375

Jane F. Kuhl • Head, Technology Transfer Office (202) 767-3083 • kuhl@utopia.nrl.navy.mil
Douglas B. Chrisey, Ph.D. • Head, Plasma Processing Section (202) 767-4788