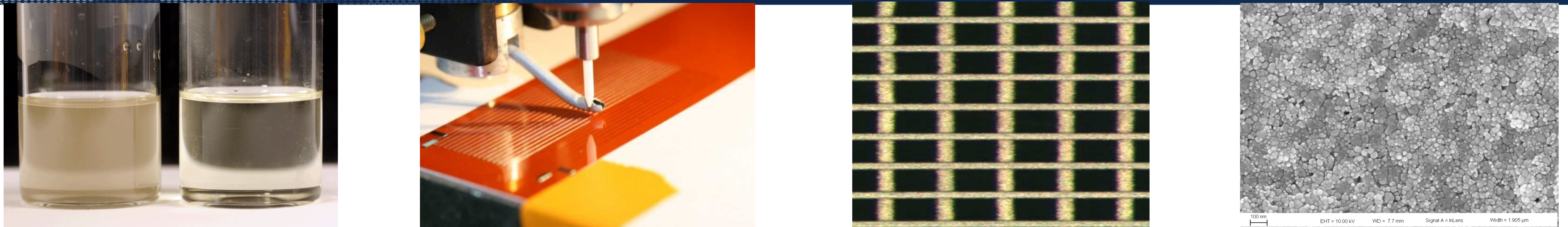


Exceptional service in the national interest



Silver Ink For Conductor Printing

Many applications require the ability to print conductors on devices that cannot tolerate high temperatures. Current methods for making printable conductors generally consist of silver nanoparticles or silver flake suspended in a suitable solvent amenable to printing. These silver metal suspension formulations require high processing temperatures to sinter the particles (180 °C). They leave behind unwanted by-products (usually surfactants) and demonstrate significantly reduced performance at high frequency due to voids remaining in the printed line after thermal processing. These nanoparticle and flake suspensions also tend to precipitate, resulting in shortened shelf life and clogging in certain printing operations.

Sandia has developed a superior process for creating ultra-low temperature curing silver inks. This technology is specifically designed to avoid the use of silver flake, nanoparticles, and surfactants. This system is a silver solution consisting of a silver complex with high silver content. The solvated silver complex exhibits good stability in relatively innocuous solvents and has a very low decomposition temperature (<140 °C). It produces pure silver with no residues after the curing process. The formulation provides for a long-term stable ink, volatile residues during processing, and a lower processing temperature.

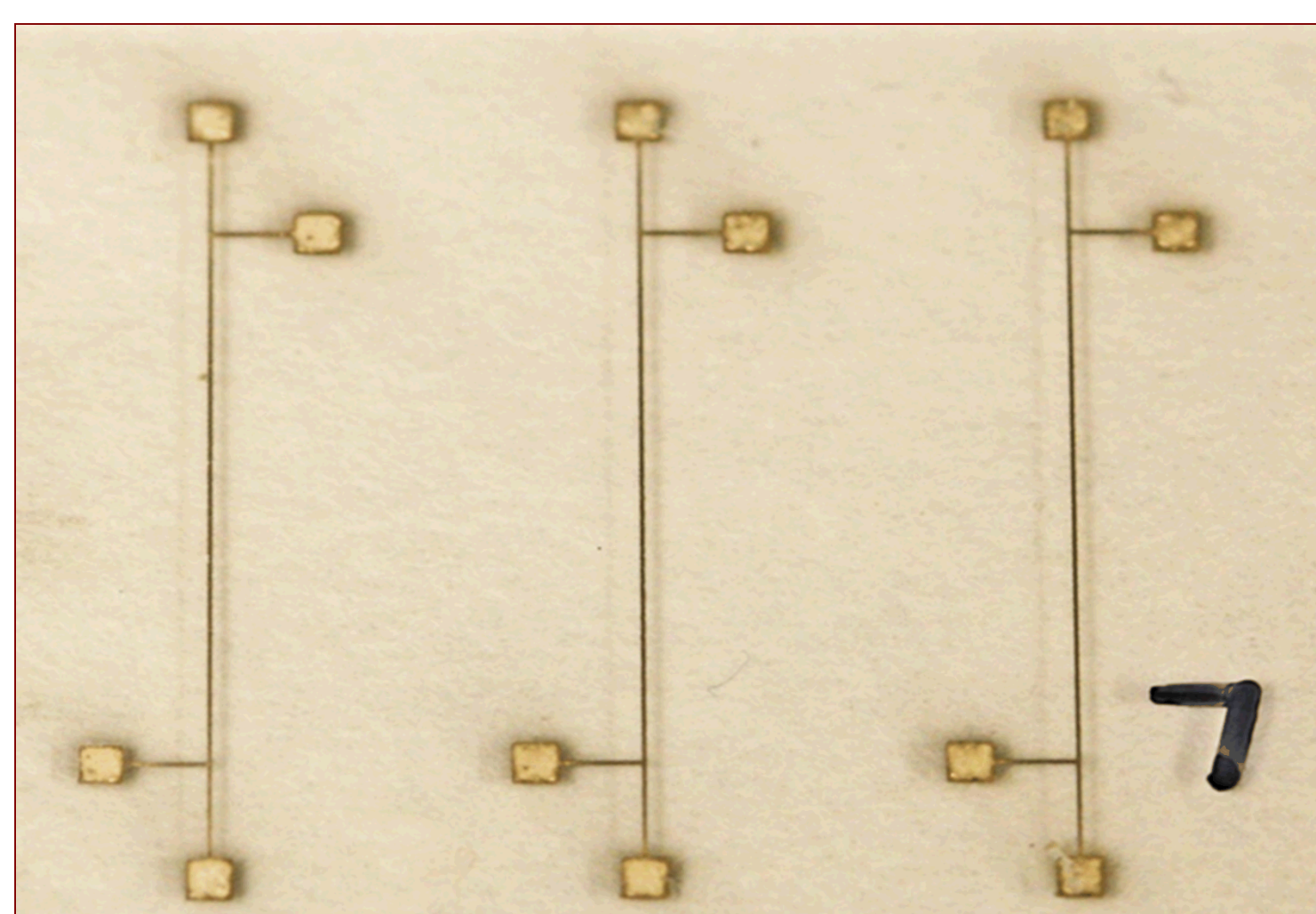
U.S. Patent Application No.
13/544,102

Applications

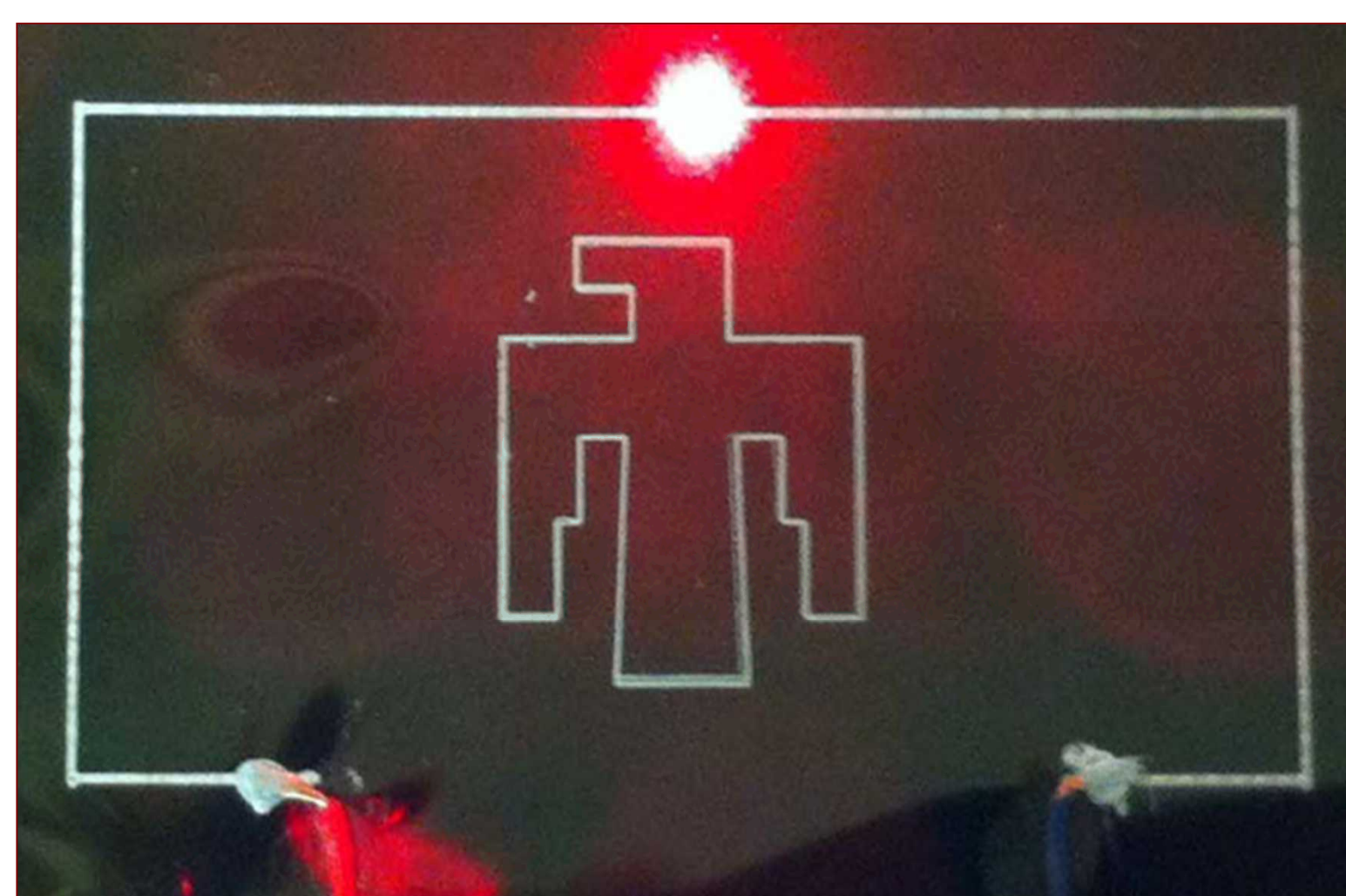
- Printable/thin film battery applications
 - Conductive polymer contacts for printable electronics
- Thin photovoltaic systems
- Conductors on flexible polymer substrates for antenna applications

Benefits

- Low temperature conversion to metallic silver
- Long-term stability
- Volatile by-products
- Avoids use of silver nanoparticles or silver flake suspensions
- Suitable for aerosol jet or ultrasonic printing and microcasting



Aerosol jet printing of a 4-point DC test structure using silver ink cured at 120°C.



Functional circuit printed on Kapton® using silver ink cured at 140°C.