Successful formation of fine and high aspect ratio patterning with laser assisted ink-jet printing

Industrial ink-jet printing for low resistance wiring on various kinds of substrates

In order to reduce the line width and to improve the patterning throughput on ink-jet printing, a CO_2 laser was irradiated during printing. This method is named laser assisted ink-jet printing (LIJ). The drawing conditions such as droplet size, ejection frequency, laser irradiation power, and stage speed were optimized. As a result, fine line patterns of silver (Ag) with 7~10 μm width and over 10 μm thickness were obtained by using the 25 μm droplets in diameter, which were ejected from a single nozzle head. The aspect ratio and the drawing speed of the Ag line reached over 1:1 and 10 mm/sec (60 cm/min) without a re-coating process. The line width with laser irradiation was 20~25 times smaller than that without laser irradiation. The thickness with laser irradiation was over 10 times larger than that without laser irradiation.

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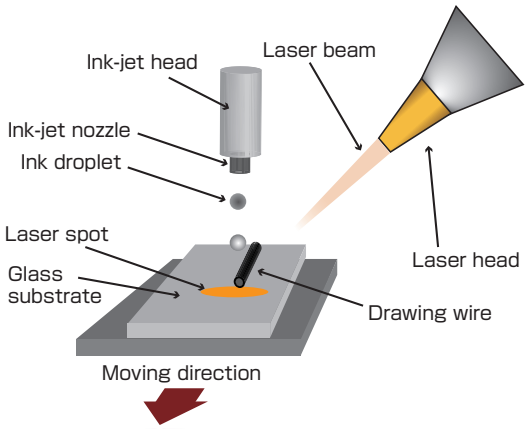

Laser assisted ink-jet printing

Electrical measuring method for quantum states

Applications in quantum information processing are expected

We have established the theoretical foundation for a method to electrically measure the quantum superposition of the two spin states (singlet and triplet) of two electrons captured in a semiconductor double quantum dot. With conventional methods, only the probability of singlet and triplet spin states could be measured. Since the new method can also detect the quantum-mechanical relative phase of the two states, the two-electron spin states are fully measured. This method is valuable not only in the context of basic physics but also as a means for confirming the initialization of the quantum states and reading out the computed results that are necessary to develop a quantum information processing device. Therefore, this method is expected to contribute to the development of quantum information processing devices based on semiconductor artificial molecules.

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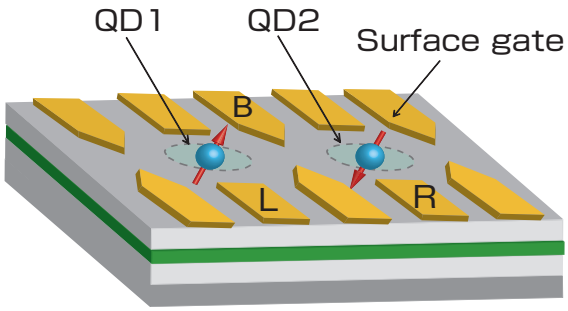

Schematic illustration of a double quantum dot
Electrons are represented by the blue spheres and their spins are indicated by the red arrows. The regions where electrons are confined are represented by the dotted circles. Surface gates are indicated by the yellow plates. The double quantum dot is connected to the source and drain electrodes.