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Laser induced nanowelding, nanosoldering, nanobreaking and nanohealing

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Nanojoining (including nanowelding, nanosoldering, etc.) of nanostructures offers the opportunity of constructing complex structures and advanced functional devices at the nanoscale. Based on the laser-induced photothermal effects, here the single point nanowelding technology is demonstrated for joining metallic nanowires with metallic nanowires or nanoplates, or forming metal-semiconductor heterojunctions. We also proposed and demonstrated the optically controlled local nanosoldering technology, which ensures the nanostructures to be bonded while their original structural integrity is retained. Typical elemental devices (V-shaped, T-shaped, and X-shaped nanostructures) are formed with our nanowelding and nanosoldering technology. Nanobreaking and nanohealing of nanowires has also shown its necessity for manufacturing integrated nanodevices as nanojoining does. We developed a method for breaking gold pentagonal nanowires with a laser. We also showed that it is possible to heal nanogaps between two silver nanowires. All these techniques show great potentials for high-performance electronic and photonic devices based on nanowires, such as nanoelectronic circuits and plasmonic nanodevices.

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