

ABSTRACT

A laser annealing apparatus includes: a laser beam generator for providing a stable single-pulse laser; a cyclic delay unit (300) for splitting the single-pulse laser into several pulsed lasers; an optical module for converging one or more of the pulsed lasers on a substrate (204); and a movable stage (500) for providing the substrate (204) with movement in at least one degree of freedom. A laser annealing method includes: providing a stable single-pulse laser; splitting the single-pulse laser into several pulsed lasers according to a delay requirement and an energy ratio; and irradiating a substrate (204) successively with one or more of the pulsed lasers to keep a surface temperature of the wafer around the melting point or around a needed annealing temperature for a sufficiently long time during the annealing process, thus resulting in an improvement in both the laser energy utilization efficiency and effect of the annealing process.