TITLE OF INVENTION: A COMBINED DUAL-WAVELENGTH LASER LIGHT PROCESSING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The invention relates to a combined dual-wavelength laser light processing device, especially to one that control two kinds of wavelength beams to form a composite light wave configuration with the same optical axis, and then through repeated conversion of double wavelengths, the processing of composite materials can achieve fast and accurate results.

2. Description of the Related Art

In recent years, laser cutting technology has been widely used to cut hard and transparent materials such as light-emitting diode substrates or tempered glass; laser cutting technology is using laser light focus on the processed material to produce local thermal melting damage, wherein the laser light source mainly includes a high-energy laser beam and uses an energy controller to regulate the energy of the laser beam.

Laser applications in various processes have become more and more popular, and most of them use lasers with 1064nm wavelength and 532nm wavelength to meet different requirements; for example, in the electronics industry, 1064nm wavelength is used to calibrate embedded carbon film resistors, and 532nm wavelength is used to calibrate the resistance of metal alloys; in the semiconductor back-end process, 1064nm wavelength is used for film printing, and 532nm wavelength is used to cut wafers; in the consumer electronics industry, 1064nm and 532nm wavelength lasers are

used to cut flash memory to form special shapes.

Semiconductor wafer **100**, as shown in FIG. 1, having a plurality of chips **100a** or grains **100b** formed on its upper surface; to separate the chips **100a** and grains **100b** from the semiconductor wafer **100**, the semiconductor wafer **100**are covered with a series of vertical scribe line or saw lane **102**, **104**. The process of separating the wafers is known as "wafer dicing". The wafers are covered with many different layers, such as protective layers of oxide or nitride, dielectric layers, polymer films, and metal pads of aluminum and copper; wherein, the different materials have non-homogeneity, so that will cause great trouble when the wafer is diced during the manufacturing process. The current method in the industry is to use a double-cutting method with two wavelengths of lasers; firstly, the protective layer is cut by the laser beam of the first wavelength, and after the cutting of the protective layer is completed, using the laser beam of the second wavelength to cut the material of the lower layer of the substrate; however, in the separate two-pass construction method, the work piece must be displaced twice, which wastes working hours and energy. Moreover, the interval between the two passes is very long, and the material of the protective layer is easily fused again and affects the cutting operation of the second pass; therefore, how to shorten the working hours and reduce energy waste while ensuring the quality of the wafer dicing process has become a subject of the present invention.

SUMMARY OF THE INVENTION

It is a primary objective of the present invention to provide a combined dual-wavelength laser light processing device designed for wafer dicing.

It is another objective of the present invention to provide a coaxial composite light wave configuration that can control two kinds of wavelength beam, and then through the repeated conversion of the dual wavelengths in the composite light wave configuration make the processing of the composite material to be fast and precise.

It is another objective of the present invention to provide a laser light processing device that guides the finished light beam through the galvanometer scanning module so as to process the work piece without shifting the work platform.

In order to achieve the above objectives, the present invention including: a first laser light source for emitting a first wavelength beam; a second laser light source for emitting a second wavelength beam, arranged at the lateral side of the first laser light source; at least one Bessel beam lens is arranged behind one of the first laser light source or second laser light source, so that one of the first wavelength beam or second wavelength beam forms a Bessel beam; a coaxial reflecting mirror composed of two triangular prism mirrors, the combination surfaces of the triangular prism mirrors are individually coated with a coating, the coaxial reflecting mirror is correspondingly arranged on the optical path of the Bessel beam and the wavelength beam of the first wavelength beam or second wavelength beam, so as to form a coaxial finished light beam, and the finished light beam includes a first finished light beam and a finished light beam; a diffraction optical unit is arranged behind the coaxial reflecting mirror and on the optical path of the finished light beam, for adjusting the energy distribution of the finished light beam; a work platform for supporting a work piece for processing operations; a laser

galvanometric scanning module is arranged behind the diffraction optical unit and above the work platform, so as to guide the finished light beam to the work platform; a controller electrically connected to the first laser light source, the second laser light source and the laser galvanometric scanning module, wherein the controller timely adjusts the angle of the laser galvanometric scanning module during processing, so as to guide the finished light beam projected to any position of the two-dimensional coordinates of the work platform; the controller controls the projection timing and energy of the first wavelength beam and the second wavelength beam, and make the first finished light beam and the second finished light beam combine to form a composite light wave configuration with at least one rectangular pulse and at least one burst pulse, and then through the repeated conversion of the dual wavelengths in the composite light wave configuration make the processing of the composite material to be fast and precise.

The present invention has another method including: a first laser light source for emitting a first wavelength beam; a second laser light source for emitting a second wavelength beam, arranged at the lateral side of the first laser light source; a coaxial reflecting mirror and a second reflecting mirror are arranged on the optical path of the first wavelength beam and the second wavelength beam correspondingly, the second reflecting mirror deflects the second wavelength beam to the coaxial reflecting mirror, and the coaxial reflecting mirror are composed of two triangular prism mirrors, the combination surfaces of the triangular prism mirrors are individually coated with a coating, which allow the incoming first wavelength beam to penetrate and the second wavelength beam to deflect, so as to form a coaxial finished

light beam, and the finished light beam includes a first finished light beam and a finished light beam; a diffraction optical unit is arranged behind the coaxial reflecting mirror and on the optical path of the finished light beam, for adjusting the energy distribution of the finished light beam; a work platform for supporting a work piece for processing operations; a laser galvanometric scanning module is arranged behind the diffraction optical unit and above the work platform, so as to guide the finished light beam to the work platform; a multi focal length lens arranged between the laser galvanometric scanning module and the work platform for precisely focusing the finished light beam on the work piece; a controller electrically connected to the first laser light source, the second laser light source and the laser galvanometric scanning module, wherein the controller timely adjusts the angle of the laser galvanometric scanning module during processing, so as to guide the finished light beam projected to any position of the two-dimensional coordinates of the work platform; the controller controls the projection timing and energy of the first wavelength beam and the second wavelength beam, and make the first finished light beam and the second finished light beam combine to form a composite light wave configuration with at least one rectangular pulse and at least one burst pulse, and then through the repeated conversion of the dual wavelengths in the composite light wave configuration make the processing of the composite material to be fast and precise.

Also, the first wavelength beam has a wavelength of 532nm, and the second wavelength beam has a wavelength of 1064nm.

Also, the Bessel beam lens has an axicon lens, multiple lenses, and a

spatial filter to form a Bessel beam with long focal length.

Also, the Bessel beam lens is a first Bessel beam lens, the Bessel beam is a first Bessel beam.

Also, the present invention further includes a second Bessel beam lens, which corresponds to the first Bessel beam lens, and is arranged behind one of the other first laser light source or second the laser light source, so as to make one of the other first wavelength beam or second wavelength beam to form a second Bessel beam; and the coaxial reflecting mirror is correspondingly arranged on the optical path of the first Bessel beam and the second Bessel beam to form a coaxial finished light beam.

Also, the coaxial reflecting mirror is correspondingly arranged on the optical path of the first Bessel beam, a second reflecting mirror is correspondingly arranged on the optical path of the second Bessel beam, the second reflecting mirror deflects the second Bessel beam to the coaxial reflecting mirror, and the coating of the coaxial reflecting mirror allows the incoming first Bessel beam to penetrate and the second Bessel beam to deflect, so as to form a coaxial finished light beam.

Also, the present invention further includes a first reflecting mirror and a second reflecting mirror correspondingly arranged on the optical path of the first Bessel beam and the second Bessel beam, deflect the first Bessel beam and the second Bessel beam to the coaxial reflecting mirror, and the coating of the coaxial reflecting mirror allows the incoming first Bessel beam and the second Bessel beam to deflect, so as to form a coaxial finished light beam.

Also, the laser galvanometric scanning module has a third reflecting

mirror and a X-Y scan lens, and by the reflection of the third reflecting mirror and the focusing of the X-Y scan lens, the finished light beam is guided to project on the required processing point of the work piece.

Also, the controller includes a master oscillator power-amplifier or an acousto optic modulator for controlling the projection timing and energy of the first wavelength beam and the second wavelength beam, and make the first finished light beam and the second finished light beam combine to form a composite light wave configuration.

Also, the composite light wave configuration has a first composite light wave configuration with a periodic cycle, which includes a rectangular pulse A, a rectangular pulse B, and a burst pulse A in sequence, each pulses has a retention time their own, and the wavelength of the rectangular pulse A $\leqq$ the rectangular pulse B, also the height and width of the burst pulse A can be adjusted.

Also, the composite light wave configuration has a second composite light wave configuration with a periodic cycle, which includes a rectangular pulse A, a burst pulse A, a rectangular pulse B, and a burst pulse B in sequence, each pulses has a retention time their own, and the wavelength of the rectangular pulse A $\leqq$ the rectangular pulse B, also the height and width of the burst pulse A and the burst pulse B be adjusted.

With features disclosed above, the present invention arranges the Bessel beam lens after the laser light source, so as to form a Bessel beam with long focal length; Using the coating of the coaxial reflecting mirror, so as to make the Bessel beam to form a coaxial finished light beam; Making the controller electrically connected to the two laser light sources, and using the controller

controls the projection timing and energy of the first wavelength beam and the second wavelength beam, and make the finished light beams to form a composite light wave configuration with at least one rectangular pulse and at least one burst pulse, wherein the first composite light wave configuration has two rectangular pulses and one burst pulse, the second composite light wave configuration has two rectangular pulses and two burst pulses, and the wavelength of the rectangular pulse $\leqq$ the burst pulse; the present invention uses the repeated conversion of the dual wavelengths of the rectangular pulses A and the rectangular pulses B in the composite light wave configuration to cut the protective layer of the wafer with the rectangular pulses A of the wavelength of 532nm, and then cuts the material of the lower layer of the substrate with the rectangular pulses B of the wavelength of 1064nm, so as to solve the disadvantage of two individual displacements required in the conventional wafer dicing; Therefore the present invention can achieve rapid and precise results in the processing of composite materials. Moreover, the present invention can use the characteristics of the rectangular pulse which releasing huge energy instantaneously in the composite light wave configuration, and the characteristics of the burst pulse which avoiding energy failure through vibration, so the present invention can be applied to the processing of multi-layer structures of different materials, and it make the finished light beam to achieve low energy consumption, narrow working hot spots, and high aspect ratio processing benefits. Moreover, the present invention uses the controller to control the reflection of the third reflecting mirror in the laser galvanometric scanning module and the focusing of the X-Y scan lens, so as to guide the finished light beam to any position of the two-

dimensional coordinates of the work platform; since there is no need to displace the work platform during laser processing of the work piece, therefore, the present invention can greatly improve the working efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram illustrating the structure of the semiconductor wafer dicing of the prior art;

FIG. 2A is a schematic diagram illustrating the structure of the first embodiment of the present invention;

FIG. 2B is a schematic diagram illustrating the structure of the second embodiment of the present invention;

FIG. 2C is a schematic diagram illustrating the structure of the third embodiment of the present invention;

FIG. 3A is a schematic diagram illustrating the structure of the Bessel beam lens of the present invention;

FIG. 3B is a schematic diagram illustrating the structure of the multi focal length lens of the present invention;

FIG. 4A is a schematic diagram illustrating the first kind of the structure of the coaxial reflecting mirror of the present invention;

FIG. 4B is a schematic diagram illustrating the second kind of the structure of the coaxial reflecting mirror of the present invention;

FIG. 5 is a schematic diagram illustrating the structure of the first composite light wave configuration of the present invention;

FIG. 6 is a schematic diagram illustrating the structure of the second

composite light wave configuration of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 2A, the first embodiment **100** of the present invention, including: a first laser light source **11** for emitting a first wavelength beam **111** with wavelength of 532nm; a second laser light source **12** for emitting a second wavelength beam **121** with wavelength of 1064nm, arranged at the lateral side of the first laser light source **11**; a first Bessel beam lens **20A** is arranged behind one of the first laser light source **11** to forms a first Bessel beam **201**; a coaxial reflecting mirror **30** arranged on the optical path of the first Bessel beam **201**, a second reflecting mirror **40B** is arranged on the optical path of the second wavelength beam **121**, the second reflecting mirror **40B** deflects the second wavelength beam **121** to the coaxial reflecting mirror **30**, and the coaxial reflecting mirror **30** is composed of two triangular prism mirrors **31**, the combination surfaces **311** of the triangular prism mirrors **31** are individually coated with a coating **32** allowing the incoming first Bessel beam **201** and the second wavelength beam **121** to form a coaxial finished light beam **35**, and the finished light beam **35** includes a first finished light beam **351** and a finished light beam **352**; a diffraction optical unit **70** is arranged behind the coaxial reflecting mirror **30** and on the optical path of the finished light beam **35**, for adjusting the energy distribution of the finished light beam **35**; a work platform **50** for supporting a work piece **51** for processing operations; a laser galvanometric scanning module **60** is arranged behind the diffraction optical unit **70** and above the work platform **50**, the laser galvanometric scanning module **60** has a third reflecting mirror **61** and a X-Y scan lens **62**, and by the reflection of the third reflecting mirror

61 and the focusing of the X-Y scan lens **62**, the finished light beam **35** is guided to project on the required processing point of the work piece **51**; a controller **80** includes a master oscillator power-amplifier or an acousto optic modulator, the master oscillator power-amplifier can achieve high pulse energy and high average output power and the acousto optic modulator can boost the intensity of the laser beam; the controller **80** is electrically connected to the first laser light source **11**, the second laser light source **12** and the laser galvanometric scanning module **60**, wherein the controller **80** timely adjusts the angle of the laser galvanometric scanning module **60** during processing, so as to guide the finished light beam **35** projected to any position of the two-dimensional coordinates of the work platform **50**; the controller **80** controls the projection timing and energy of the first wavelength beam **111** and the second wavelength beam **121**, and make the first finished light beam **351** and the second finished light beam **352** combine to form a composite light wave configuration **90**, so as to make the processing of the composite material work piece **51** to be fast and precise.

Referring to FIG. 2B, the second embodiment **200** of the present invention, including: a first laser light source **11** for emitting a first wavelength beam **111** with wavelength of 532nm; a second laser light source **12** for emitting a second wavelength beam **121** with wavelength of 1064nm, arranged at the lateral side of the first laser light source **11**; a first Bessel beam lens **20A** and a second Bessel beam lens **20B** individually arranged behind the first laser light source **11** and second laser light source **12**, so as to form a first Bessel beam **201** and a second Bessel beam **202**; a coaxial reflecting mirror **30** arranged on the optical path of the first Bessel beam **201**,

a second reflecting mirror **40B** is arranged on the optical path of the second Bessel beam **202**, the second reflecting mirror **40B** deflects the second Bessel beam **202** to the coaxial reflecting mirror **30**, and the coaxial reflecting mirror **30** is composed of two triangular prism mirrors **31**, the combination surfaces **(311)** of the triangular prism mirrors **31** are individually coated with a coating **32** allowing the incoming first Bessel beam **201** and the second Bessel beam **202** to form a coaxial finished light beam **35**, and the finished light beam **35** includes a first finished light beam **351** and a finished light beam **352**; a diffraction optical unit **70** is arranged behind the coaxial reflecting mirror **30** and on the optical path of the finished light beam **35**, for adjusting the energy distribution of the finished light beam **35**; a work platform **50** for supporting a work piece **51** for processing operations; a laser galvanometric scanning module **60** is arranged behind the diffraction optical unit **70** and above the work platform **50**, the laser galvanometric scanning module **60** has a third reflecting mirror **61** and a X-Y scan lens **62**, and by the reflection of the third reflecting mirror **61** and the focusing of the X-Y scan lens **62**, the finished light beam **35** is guided to project on the required processing point of the work piece **51**; a controller **80** includes a master oscillator power-amplifier or an acousto optic modulator, the master oscillator power-amplifier can achieve high pulse energy and high average output power and the acousto optic modulator can boost the intensity of the laser beam; the controller **80** is electrically connected to the first laser light source **11**, the second laser light source **12** and the laser galvanometric scanning module **60**, wherein the controller **80** timely adjusts the angle of the laser galvanometric scanning module **60** during processing, so as to guide the finished light beam **35**

projected to any position of the two-dimensional coordinates of the work platform **50**; the controller **80** controls the projection timing and energy of the first wavelength beam **111** and the second wavelength beam **121**, and make the first finished light beam **351** and the second finished light beam **352** combine to form a composite light wave configuration **90**, so as to make the processing of the composite material work piece **51** to be fast and precise.

Referring to FIG. 2C, the third embodiment **300** of the present invention, including: a first laser light source **11** for emitting a first wavelength beam **111** with wavelength of 532nm; a second laser light source **12** for emitting a second wavelength beam **121** with wavelength of 1064nm, arranged at the lateral side of the first laser light source **11**; a coaxial reflecting mirror **30** and a second reflecting mirror **40B** correspondingly arranged on the optical path of the first wavelength beam **111** and second wavelength beam **121**, the second reflecting mirror **40B** deflects the second wavelength beam **121** to the coaxial reflecting mirror **30**, and the coaxial reflecting mirror **30** is composed of two triangular prism mirrors **31**, the combination surfaces **311** of the triangular prism mirrors **31** are individually coated with a coating **32** allowing the incoming first wavelength beam **111** to penetrate and the second wavelength beam **121** to deflect to form a coaxial finished light beam **35**, and the finished light beam **35** includes a first finished light beam **351** and a finished light beam **352**; a diffraction optical unit **70** is arranged behind the coaxial reflecting mirror **30** and on the optical path of the finished light beam **35**, for adjusting the energy distribution of the finished light beam **35**; a work platform **50** for supporting a work piece **51** for processing operations; a laser galvanometric scanning module **60** is arranged behind the diffraction optical

unit **70** and above the work platform **50**, the laser galvanometric scanning module **60** has a third reflecting mirror **61** and a X-Y scan lens **62**, and by the reflection of the third reflecting mirror **61** and the focusing of the X-Y scan lens **62**, the finished light beam **35** is guided to project on the required processing point of the work piece **51**; a controller **80** includes a master oscillator power-amplifier or an acousto optic modulator; the controller **80** is electrically connected to the first laser light source **11**, the second laser light source **12** and the laser galvanometric scanning module **60**, wherein the controller **80** timely adjusts the angle of the laser galvanometric scanning module **60** during processing, so as to guide the finished light beam **35** projected to any position of the two-dimensional coordinates of the work platform **50**; the controller **80** controls the projection timing and energy of the first wavelength beam **111** and the second wavelength beam **121**, and make the finished light beam **35** having a composite light wave configuration **90** with at least one rectangular pulse **91** and at least one burst pulse **92**, and then through the repeated conversion of the dual wavelengths in the composite light wave configuration **90** make the processing of the composite material work piece **51** to be fast and precise.

As shown in FIG. 3A, the first Bessel beam lens **20A** has an axicon lens **21**, multiple lenses **22**, and a spatial filter **23** to make the first wavelength beam **111** forming a first Bessel beam **201** with long focal length; the structure of the first Bessel beam lens **20B** and forming method second Bessel beam **202** is same as method shown in FIG. 3A. The aforementioned Bessel beam is a wave, which has the characteristics no dispersion in the direction of upward transmission, very small central light (only tens of microns), and

self-recovery after encountering obstacles during the transmission process. On the other hand, the Bessel beam is a special non-diffraction beam, which has a large focus depth; it will form a stretching focus area when focusing, and has a unique longitudinal focus characteristic.

As shown in FIG. 3B, the multi focal length lens **63** is composed of multiple lenses **631**; after the finished light beam **35** passes through this multiple lenses **631**, multiple focal points **36** will be formed and arranged in a straight line from the surface of the work piece **51** to the inside, and the multiple focal points **36** can be formed on the work piece **51**, at the same time, laser processing is applied at multiple focal points **36**, so the present invention can let the finished light beam **35** accurately focus on the work piece **51**.

As above mentioned, the coaxial reflecting mirror **30** is coated with a coating **32** for the incoming light beam to penetrate or deflect, so as to form a coaxial finished light beam **35**. As shown in FIG. 4A, in the first and second embodiment use the coaxial reflecting mirror **30** as the first structure to form coaxial finished light beam **35**; wherein the coaxial reflecting mirror **30** is correspondingly arranged on the optical path of the first Bessel beam **201**, a second reflecting mirror **40B** is correspondingly arranged on the optical path of the second Bessel beam **202**, the second reflecting mirror **40B** deflects the second wavelength beam **121** or the second Bessel beam **202** to the coaxial reflecting mirror **30**, and the coating **32** of the combination surfaces **311** of the triangular prism mirrors **31** of the coaxial reflecting mirror **30** allows the incoming first Bessel beam **201** to penetrate and the second wavelength beam **121** or the second Bessel beam to deflect, so as to form a coaxial first finished

light beam **351** and a second finished light beam **352**. Moreover, As shown in FIG. 4B, which is the second structure to form coaxial finished light beam **35** by the coaxial reflecting mirror **30**; wherein including a first reflecting mirror **40A** and a second reflecting mirror **40B** correspondingly arranged on the optical path of the first Bessel beam **201** and the second wavelength beam **121** or the second Bessel beam **202**, individually deflects the first Bessel beam **201**, the second wavelength beam **121** or the second Bessel beam **202** to the coaxial reflecting mirror **30**, and the coating **32** of the combination surfaces **311** of the triangular prism mirrors **31** of the coaxial reflecting mirror **30** allows the incoming the first Bessel beam **201** and the second wavelength beam **121** or the second Bessel beam **202** to deflect, so as to form coaxial first finished light beam **351** and a second finished light beam **352**.

Referring to FIGS. 5~6, which showing the structure of the composite light wave configuration **90**; the controller **80** is electrically connected to the first laser light source **11** and the second laser light source **12**, the controller **80** controls the projection timing and energy of the first wavelength beam **111** and the second wavelength beam **121**, and make the finished light beam **35** having a composite light wave configuration **90** with at least one rectangular pulse **91** and at least one burst pulse **92**; wherein a first composite light wave configuration **901**, as shown in FIG. 5, is a module having a periodic cycle, it comprises a rectangular pulse A **911**, a rectangular pulse B **912**, and a burst pulse A **921** in sequence, and each pulses has a retention time their own **931, 932, 933**, the wavelength of the rectangular pulse A **911** ≦the rectangular pulse B **912**, and the height and width of the burst pulse A **921** can be adjusted. Also, a second composite light wave configuration **902**,

as shown in FIG. 6, is a module having a periodic cycle, it comprises a rectangular pulse A **911**, a burst pulse A **921**,a rectangular pulse B **912**, and a burst pulse B **922** in sequence, and each pulses has a retention time their own **931, 932, 933**, **934**, the wavelength of the rectangular pulse A **911**≦the rectangular pulse B **912**, and the height and width of the burst pulse A **921** and the burst pulse B **922** can be adjusted.

The second embodiment **200** of the present invention arranges a first Bessel beam lens **20A** and a second Bessel beam lens **20B** individually arranged behind the first laser light source **11** and second laser light source **12**, so as to form a first Bessel beam **201** and a second Bessel beam **202**; through the coaxial reflecting mirror **30** with the coating **32**, making the first Bessel beam **201** and the second Bessel beam **202** to form a coaxial finished light beam **35**; through the controller **80** electrically connected to the first laser light source **11** and the second laser light source **12** to control the projection timing and energy of the first wavelength beam **111** and the second wavelength beam **121**, and make the finished light beam **35** a form a composite light wave configuration **90** composed of a rectangular pulse **91** and a burst pulse **92**; wherein the first composite light wave configuration **901** comprises two rectangular pulses **91** and a burst pulse **92**, the second composite light wave configuration **902** comprises two rectangular pulses **91** and two burst pulses **92**, and the wavelength of the rectangular pulse A **911** ≦the rectangular pulse B **912**; through the repeated conversion of the dual wavelengths of the wavelength of the rectangular pulse A **911** and the rectangular pulse B **912** in the composite light wave configuration **90**, using the rectangular pulse A **911** with a wavelength of 532nm to cut the protective

layer of the wafer, and then use the rectangular pulse B **912** with a wavelength of 1064nm to cut the substrate of the lower layer of the wafer, so as to solve the disadvantage of two individual displacements required in the conventional wafer dicing; so the present invention make the processing of the composite material work piece **51** to be fast and precise. Moreover, characteristic**.** Moreover, the present invention can use the characteristics of the rectangular pulse **91** which releasing huge energy instantaneously in the composite light wave configuration **90**, and the characteristics of the burst pulse **92** which avoiding energy failure through vibration, so the present invention can be applied to the processing of multi-layer structures of different materials, and it make the finished light beam **35** to achieve low energy consumption, narrow working hot spots, and high aspect ratio processing benefits. Moreover, the present invention uses the controller **80** to control the reflection of the third reflecting mirror **61** in the laser galvanometric scanning module **60** and the focusing of the X-Y scan lens **62**, so as to guide the finished light beam **35** to any position of the two-dimensional coordinates of the work platform **50**; since there is no need to displace the work platform **50** during laser processing of the work piece **51**, therefore, the present invention can greatly improve the working efficiency.

Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

What Is Claimed Is:

1. A combined dual-wavelength laser light processing device, comprising:

a first laser light source **(11)** for emitting a first wavelength beam **(111)**;

a second laser light source **(12)** for emitting a second wavelength beam **(121)**, arranged at the lateral side of the first laser light source **(11)**;

at least one Bessel beam lens is arranged behind one of the first laser light source **(11)** or second laser light source **(12)**, so that one of the first wavelength beam **(111)** or second wavelength beam **(121)** forms a Bessel beam;

a coaxial reflecting mirror **(30)** composed of two triangular prism mirrors **(31)**, the combination surfaces **(311)** of the triangular prism mirrors **(31)** are individually coated with a coating **(32)**, the coaxial reflecting mirror **(30)** is correspondingly arranged on the optical path of the Bessel beam and the wavelength beam of the first wavelength beam **(111)** or second wavelength beam **(121)**, so as to form a coaxial finished light beam **(35)**, and the finished light beam **(35)** includes a first finished light beam **(351)** and a finished light beam **(352)**;

a diffraction optical unit **(70)** is arranged behind the coaxial reflecting mirror **(30)** and on the optical path of the finished light beam **(35)**, for adjusting the energy distribution of the finished light beam **(35)**;

a work platform **(50)** for supporting a work piece **(51)** for processing operations;

a laser galvanometric scanning module **(60)** is arranged behind the diffraction optical unit **(70)** and above the work platform **(50)**, so as to guide

the finished light beam **(35)** to the work platform **(50)**;

a controller **(80)** electrically connected to the first laser light source **(11)**, the second laser light source **(12)** and the laser galvanometric scanning module **(60)**, wherein the controller **(80)** timely adjusts the angle of the laser galvanometric scanning module **(60)** during processing, so as to guide the finished light beam **(35)** projected to any position of the two-dimensional coordinates of the work platform **(50)**; the controller **(80)** controls the projection timing and energy of the first wavelength beam **(111)** and the second wavelength beam **(121)**, and make the first finished light beam **(351)** and the second finished light beam **(352)** combine to form a composite light wave configuration **(90)** with at least one rectangular pulse **(91)** and at least one burst pulse **(92)**, and then through the repeated conversion of the dual wavelengths in the composite light wave configuration **(90)** make the processing of the composite material to be fast and precise.

2. A combined dual-wavelength laser light processing device, comprising:

a first laser light source **(11)** for emitting a first wavelength beam **(111)**;

a second laser light source **(12)** for emitting a second wavelength beam **(121)**, arranged at the lateral side of the first laser light source **(11)**;

a coaxial reflecting mirror **(30)** and a second reflecting mirror **(40B)** are arranged on the optical path of the first wavelength beam **(111)** and the second wavelength beam **(121)** correspondingly, the second reflecting mirror **(40B)** deflects the second wavelength beam **(121)** to the coaxial reflecting mirror **(30)**, and the coaxial reflecting mirror **(30)** are composed of two triangular prism mirrors **(31)**, the combination surfaces **(311)** of the triangular

prism mirrors **(31)** are individually coated with a coating **(32)**, which allow the incoming first wavelength beam **(111)** to penetrate and the second wavelength beam **(121)** to deflect, so as to form a coaxial finished light beam **(35)**, and the finished light beam **(35)** includes a first finished light beam **(351)** and a finished light beam **(352)**;

a diffraction optical unit **(70)** is arranged behind the coaxial reflecting mirror **(30)** and on the optical path of the finished light beam **(35)**, for adjusting the energy distribution of the finished light beam **(35)**;

a work platform **(50)** for supporting a work piece **(51)** for processing operations;

a laser galvanometric scanning module **(60)** is arranged behind the diffraction optical unit **(70)** and above the work platform **(50)**, so as to guide the finished light beam **(35)** to the work platform **(50)**;

a multi focal length lens **(63)** arranged between the laser galvanometric scanning module **(60)** and the work platform **(50)** for precisely focusing the finished light beam on the work piece **(51)**;

a controller **(80)** electrically connected to the first laser light source **(11)**, the second laser light source **(12)** and the laser galvanometric scanning module **(60)**, wherein the controller **(80)** timely adjusts the angle of the laser galvanometric scanning module **(60)** during processing, so as to guide the finished light beam **(35)** projected to any position of the two-dimensional coordinates of the work platform **(50)**; the controller **(80)** controls the projection timing and energy of the first wavelength beam **(111)** and the second wavelength beam **(121)**, and make the first finished light beam **(351)** and the second finished light beam **(352)** combine to form a composite light

wave configuration **(90)** with at least one rectangular pulse **(91)** and at least one burst pulse **(92)**, and then through the repeated conversion of the dual wavelengths in the composite light wave configuration **(90)** make the processing of the composite material to be fast and precise.

3. The combined dual-wavelength laser light processing device as claimed in claim 1 and claim 2, wherein the first wavelength beam **(111)** has a wavelength of 532nm, and the second wavelength beam **(121)** has a wavelength of 1064nm.

4. The combined dual-wavelength laser light processing device as claimed in claim 1, wherein the Bessel beam lens has an axicon lens **(21)**, multiple lenses, and a spatial filter to form a Bessel beam with long focal length.

5. The combined dual-wavelength laser light processing device as claimed in claim 1, wherein the Bessel beam lens is a first Bessel beam lens **(20A)**, the Bessel beam is a first Bessel beam **(201)**.

6. The Combined dual-wavelength laser light processing device as claimed in claim 5, wherein further includes a second Bessel beam lens **(20B)**, which corresponds to the first Bessel beam lens **(20A)**, and is arranged behind one of the other first laser light source **(11)** or second the laser light source **(12)**, so as to make one of the other first wavelength beam **(111)** or second wavelength beam **(121)** to form a second Bessel beam **(202)**; and the coaxial reflecting mirror **(30)** is correspondingly arranged on the optical path of the first Bessel beam **(201)** and the second Bessel beam **(202)** to form a coaxial finished light beam.

7. The combined dual-wavelength laser light processing device as

claimed in claim 6, wherein the coaxial reflecting mirror **(30)** is correspondingly arranged on the optical path of the first Bessel beam **(201)**, a second reflecting mirror **(40B)** is correspondingly arranged on the optical path of the second Bessel beam **(202)**, the second reflecting mirror **(40B)** deflects the second Bessel beam **(202)** to the coaxial reflecting mirror **(30)**, and the coating **(32)** of the coaxial reflecting mirror **(30)** allows the incoming first Bessel beam **(201)** to penetrate and the second Bessel beam **(202)** to deflect, so as to form a coaxial finished light beam **(35)**.

8. The combined dual-wavelength laser light processing device as claimed in claim 6, wherein further includes a first reflecting mirror **(40A)** and a second reflecting mirror **(40B)** correspondingly arranged on the optical path of the first Bessel beam **(201)** and the second Bessel beam **(202)**, deflect the first Bessel beam **(201)** and the second Bessel beam **(202)**to the coaxial reflecting mirror **(30)**, and the coating **(32)** of the coaxial reflecting mirror **(30)** allows the incoming first Bessel beam **(201)** and the second Bessel beam **(202)** to deflect, so as to form a coaxial finished light beam **(35)**.

9. The combined dual-wavelength laser light processing device as claimed in claim 1 or claim 2, wherein the laser galvanometric scanning module **(60)** has a third reflecting mirror **(61)** and a X-Y scan lens **(62)**, and by the reflection of the third reflecting mirror **(61)** and the focusing of the X-Y scan lens **(62)**, the finished light beam **(35)** is guided to project on the required processing point of the work piece **(51)**.

10. The combined dual-wavelength laser light processing device as claimed in claim 1 or claim 2, wherein the controller **(80)** includes a master oscillator power-amplifier or an acousto optic modulator for controlling the

projection timing and energy of the first wavelength beam **(111)** and the second wavelength beam **(121)**, and make the first finished light beam **(351)** and the second finished light beam **(352)** combine to form a composite light wave configuration **(90)**.

11. The combined dual-wavelength laser light processing device as claimed in claim 1 or claim 2, wherein the composite light wave configuration **(90)** has a first composite light wave configuration **(901)** with a periodic cycle, which includes a rectangular pulse A **(911)**, a rectangular pulse B **(912)**, and a burst pulse A **(921)** in sequence, each pulses has a retention time their own, and the wavelength of the rectangular pulse A **(911)** ≦the rectangular pulse B **(912)**, also the height and width of the burst pulse A **(921)** can be adjusted.

12. The combined dual-wavelength laser light processing device as claimed in claim 1 or claim 2, wherein the composite light wave configuration **(90)** has a second composite light wave configuration **(902)** with a periodic cycle, which includes a rectangular pulse A **(911)**, a burst pulse A **(921)**, a rectangular pulse B **(912)**, and a burst pulse B **(922)** in sequence, each pulses have a retention time their own, and the wavelength of the rectangular pulse A **(911)**≦the rectangular pulse B **(912)**, also the height and width of the burst pulse A **(921)** and the burst pulse B **(922)** can be adjusted.