Fiber Laser Solutions for
E-MOBILITY APPLICATIONS
IPG Innovation Drives E-MOBILITY MANUFACTURING

As EV manufacturers aim to improve production efficiencies they turn to IPG more than any other industrial laser provider. Through continuous innovation and total vertical integration, IPG provides the most reliable, energy efficient, productive and powerful lasers in the world. IPG has longstanding, proven and trusted integration within the automotive industry and intimately understands the demanding requirements of automotive production.

High reliability laser welding is needed for the millions of cylindrical batteries, pouches and prismatic cells requiring billions of welds to produce safe and efficient battery packs. IPG has committed extensive global resources towards the development and deployment of the most productive laser processing systems to enable high yield, high quality electric vehicle production and battery welding solutions.

IPG innovations include automated battery welding systems that not only weld at high speeds but also fully test modules ahead of final assembly. Adjustable mode beam lasers weld complex material configurations and inline weld process monitoring offers unmatched real-time quality assurance.

IPG continuous innovation drives unique and reliable fiber laser solutions to enable the automotive industry to boost quality, improve throughput and decrease manufacturing costs. EV manufacturers integrate IPG fiber laser solutions to address their manufacturing challenges head-on to optimize their overall production processes and produce the highest quality e-mobility components and vehicles.

Millions of battery cells require billions of welds

Laser Welding & real-time Weld Monitoring

High-quality weld

Defective weld

57% of all passenger vehicle sales by 2040 will be electric*

*Electric Vehicle Outlook 2019, BloombergNEF

Lasers Welding of cylindrical batteries

Over 10x faster & more reliable than traditional wire bonding methods

+66% of fiber lasers manufactured worldwide

13M less tonnes of global CO2 emission when operating IPG lasers compared to others

+100K Install Base

350 Patents

450 Pending

43,000 Devices shipped in 2018

Founded 1990

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IPG Photonics is the inventor and world's leading producer of high-power fiber lasers, which enable greater precision, higher-speed processing, more flexible production methods and enhanced productivity. IPG fiber lasers combine the advantages of semiconductor diodes, with the high amplification and precise beam qualities of unique optical fibers to deliver superior performance, reliability and usability.

IPG has continually pioneered the development and commercial production of numerous unique technologies related to fiber lasers combining deep materials science expertise and process know-how with a vertically-integrated business model. All key components of its fiber laser technology are produced in-house, enabling:

• Faster product development
• More efficient production methods
• Industry leading product delivery times
• Better performing, higher quality solutions
• Highest wall-plug efficiencies that lower overall energy consumption and costs

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Revolutionizing E-Mobility Applications

**1. EV BATTERY PACK MANUFACTURING**
**IPG SOLUTION:** Complete integrated systems that handle, fixture, weld, test and assemble battery packs

**CELLS TO MODULES TO PACKS**
- Robotic component handling with barcode tracking
- Individual cell testing and module fixtureing
- Busbars welded and assembled with cells
- Modules tested and reworked as needed
- Aluminum or steel enclosures welded into battery packs

**LASER WELDING AND MONITORING**
- >10 cells processed per second
- AMB lasers eliminate spatter with on-the-fly precision beam tuning
- Scan heads for consistent, reliable, high-quality cell to busbar welds
- Wobble welding for high-speed battery enclosure welding
- Inline process monitoring for real-time quality assurance to reduce defects

**2. FRAME**
**Challenge:** Cutting of ultra high-strength steel that cannot be mechanically trimmed

**3. BODY**
**Challenge:** High quality cosmetic welds that can be painted

**4. ELECTRIC MOTORS**
**Challenge:** Welding dissimilar materials at high speeds with consistent high-quality

**5. SAFETY**
**Challenge:** Reduction of cycle time with weld quality assurance for life-critical components

**6. ELECTRIC MOTOR WELDING**
**IPG SOLUTION:** YLS AMB dual-beam fiber lasers and remote scan heads optimize welding, LDD inline process monitoring assures welding quality

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IPG Technologies Increase Quality, Reliability & Safety

IPG Automated Battery Welding Systems (BWS) weld battery cells 10X faster than traditional wire bonding systems. This integrated solution delivers higher-yield EV batteries and requires less floor space with less part handling than ever before.

Automated Battery Welding Systems are custom configurable based on welding needs. Typical installations include:

- Battery cell loading
- Cell charge testing
- Assembly of battery cells
- Busbar welding and assembly

- Cells welded in < 0.1 second
- Inline weld monitoring and control
- Bed-of-nails testing: 10s of cells / second
- Traceable test results stored in cloud

**ADJUSTABLE MODE BEAM (AMB) LASERS**
- Spatter reduction on EV batteries for improved reliability and safety
- Superior welding quality of challenging dissimilar materials
- Faster, more uniform high-speed welding

**HIGH POWER SCAN HEADS**
- Consistent, precise, high-speed welding of cells to bus bars
- High strength welds with no seal damage
- Consistent penetration depth

**INLINE WELD MONITORING**
- In-weld real-time monitoring and control for optimal battery welds
- Eliminates the need for destructive testing
- Reduces scrap and increases overall throughput
- Identifies problems before processing begins

**WOBBLE WELDERS**
- Reliable, high-speed welds for battery enclosures
- Superior aesthetic finishes with no pitting or cracking
- Pressure-tested hermetic seals

**Premium Warranty & Support**

IPG is committed to providing our customers with the best warranty in the industry. All IPG lasers listed in this brochure are warranted against defects in materials and workmanship, under normal use, for a minimum of two years; three years for the YLS family of lasers with extended warranties available up to ten years.

Unlike conventional laser technologies, IPG fiber lasers require no preventive maintenance. As long as output optics and coolant are properly maintained by the customer, the laser will perform consistently without adjustment or intervention which significantly reduces downtime and maintenance costs. Customer satisfaction is our goal at IPG. Teams of dedicated service professionals and technical support specialists worldwide are available whenever and wherever you need assistance. We strive to make the best fiber lasers and amplifiers in the world and back it up with our commitment to service.

**Extensive Laser Solution Development**

IPG offers free applications development through any of our Applications Centers worldwide. We offer prototyping and feasibility studies for prospective customers to evaluate fiber lasers for their unique applications. Our industry leading knowledge of fiber laser applications accelerates and improves application development, from industrial processing to micromachining. Each of our applications labs offers customers sample processing and process development recommendations, optical metrology and metallurgy testing, application consultations and a complete results report.
IPG Photonics is the world leader in fiber laser technology, enabling greater **PRECISION**, higher **PRODUCTIVITY** and more **FLEXIBLE PRODUCTION** for industrial applications and other diverse end markets.