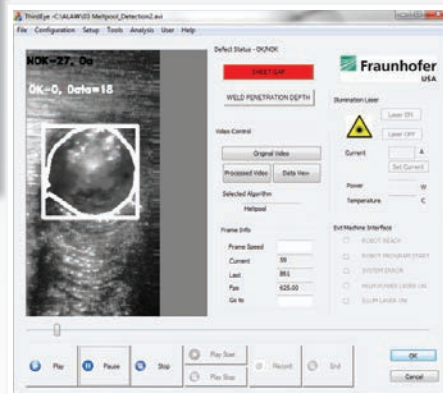


Laser Welding Process with Monitoring Setup

AREAS OF EXPERTISE

A new high resolution process monitoring system has been developed for laser welding process observation.



Process Monitoring Software

MONITORING OF LASER WELDING

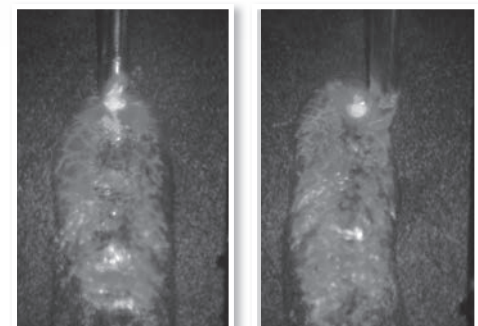
Fraunhofer has developed a high speed camera vision system that can record the welding process in high clarity in real-time and provide both image and video data from the process. This information is processed and calibrated with reference data based on pre-determined actual 'good' weld measurements. Using customized image processing software algorithms, it is possible to detect a number of common weld defects.

Technical Specifications

Description	Unit	Type/Value
Camera		CMOS
Full Resolution	pixels	1024 X1024
Pixel Size	µm	10.6 X 10.6
FOV	mm x mm	4 X 8 @650 fps 6 X 10 @400 fps
Frame Rate	frames/sec	Up to 750
Exposure time	ms	0.1 - 1000
Lens mount		C- Mount
Illumination laser		Diode
Wavelength	nm	976
Spot size	mm	∅2 - 10 mm

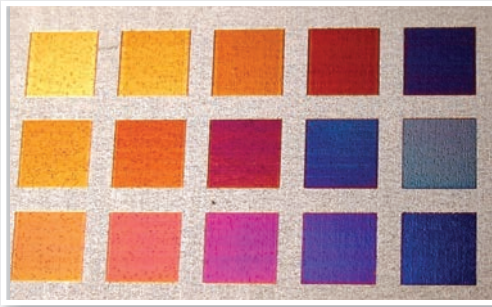


Process Monitoring System

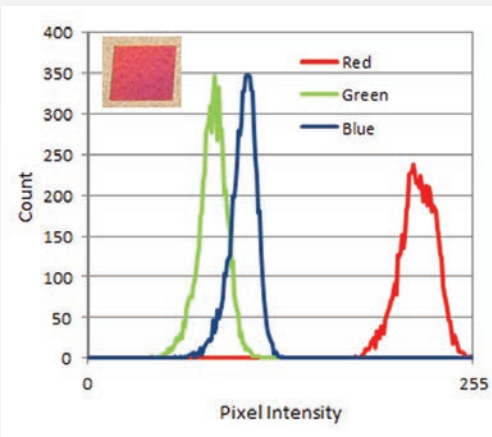


Laser Welding Process with Wire Correctly Aligned (left) and wire misalignment (right)

Laser Color Marking



Laser Color Marking Sample



Measured RGB Histogram

Color / value	Orange	Red-Orange	Red	Purple	Blue	Green
R	217	235	217	118	56	139
G	135	122	82	74	136	167
B	32	35	101	168	192	163

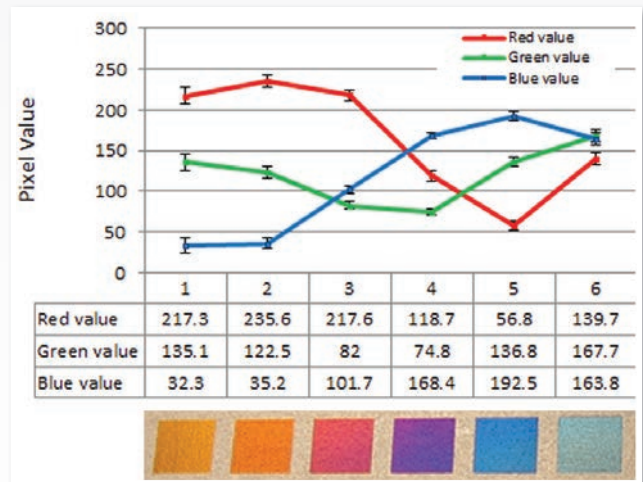
Standard Color RGB Values

AREAS OF EXPERTISE

Lasers can be used to create permanent color marking on a metal surface. Laser color marking is based on surface oxidation and thin film effects and does not use any chemicals, coatings or tools. Different colors ranging from silver and gold to blue and green can be created usually on materials such as stainless steel or titanium.

To create uniform and high quality marks, the laser must have stable high beam quality and should allow independent pulse parameter adjustment. Only changes in laser process parameters are required for changing colors.

The laser color marking process can also be monitored. Results have shown that our camera based system can measure the laser produced color mark accurately against the RGB model.



Measured Color RGB Values

ADVANTAGES

- No coatings or chemicals
- No tools or dies
- High contrast, high accuracy and high quality coloring
- Flexible marking process using digital image
- Different colors by changing the laser parameters

APPLICATIONS

- Color marking of metals
- Product marking and decoration
- High contrast marking
- Consumer products
- Tool marking