Form 2

Technology Information	
Area	Shortening working time or using remote control (Point 1.3)
Title	**SURFACE DECONTAMINATION BY LASER**
Submitted by	CEA

1. Overview of Technologies

Functions

Remove contamination from surfaces , with collection of the removed matter (gases, aerosols) on nuclear grade filters.

Summary Descriptive

Laser systems have long been seen as potentially very interesting for removing contamination from surfaces. As the main expected advantages, it was mentioned the possibility of remote process and the absence of secondary waste. However these systems were unable to find their way to an industrial deployment due to the lack of reliability of the laser and the difficulty to satisfactory collect the (contaminated) removed matter.

A system called ASPILASER has been developped at CEA/DEN/Physico-Chemistry Department based on a compact, reliable and efficient laser. It takes advantages of progress made by the fibre lasers which have now a lifetime longer than 20,000 hours without maintenance.

The principle of laser ablation is to heat up the surface very rapidly so that the matter reaches the vaporization temperature. Furthermore a shockwave eject larger particles from the surface. In our condition the typical ablation rate is of a few micrometers per pass (between 5 and 10 µm, depending on the paint). For typical layer thicknesses (30 to 300 µm) it needs between 3 and 30 passes to reach the substrate. The collecting system collects all the removed matter (gases and aerosols) on nuclear grade filters.

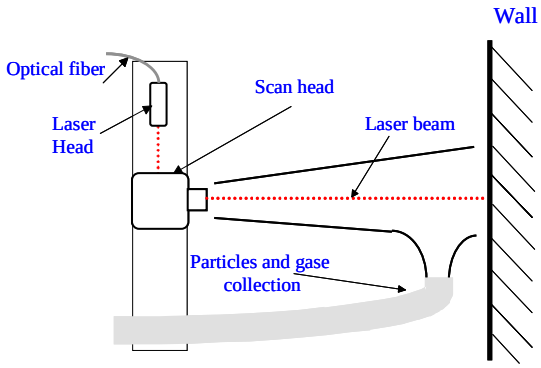
The fully automated system was tested on a vertical wall of a stopped nuclear installation. It has demonstrated an efficiency of 1 m²/hr with a low quantity of waste and the ability to work continuously without human intervention. Measurements performed after the laser treatment had shown that the contamination was completely removed by removing the paint : this contamination was not re-deposited elsewhere on the wall.

A second demonstration was conducted in a hot cell by use of a remote-operated laser system. The laser system was introduced in two parts from a 60 cm wide hole in the roof and assembled by using two telemanupilators. The decontamination factor of the walls and floor was in the same order of magnitude than for example gels.

Features & Specifications

The general scheme of the laser decontamination system is given below. It is based on industrial pulsed fiber lasers running in the near infrared (1 080 nm). They have the advantage of being compact, rugged and sealed, well adapted to industrial environment. Furthermore, they have extended lifetime up to 20,000 hours. The average output power is 50 W per laser but up to 4 of them can be associated in the same structure leading to a powerful system. The pulse width is 140 ns and the repetition rate is several tens of kHz, typically around 50 kHz in our case.

To focus and scan the laser beam over the wall surface we use a commercial scan head.



Schematic view of the laser system

It should be pointed out that when the laser is working, the system is fixed: so the collection of the particles and gases is much easier. The system can scan a unit surface of approximately 30 by 30 cm. After each scan the system is moved to the next surface. The collecting system collects all the removed matter (gases and aerosols) on nuclear grade filters.

The complete system is shown below.

Picture of the ASPILASER

Laser decontamination system in a nuclear facility in CEA/Cadarache - France

Advantages of our Technology

- High decontamination factor, no re-deposition
- Complete collection of gases and aerosols, sent to nuclear grade filters
- Waste limited to the contaminated depth (For 100 m² and 100 µm removed : 10 kg of waste)
- Completely automated, compact and scalable system
- Minimal operating requirements (no assistance gas, no cooling water, …) and constraints
- Limited worker intervention and safe (possible co-activity, absence of protection)
- Adapted to harsh environment

Owner

Five CEA Patents

2. Notes

Technology readiness level

The system ASPILASER was tested in real environment (shutdown nuclear facility and hot cell) where it showed perfomances in good agreement with expectancies.

Until 2012, the system had been industrialized by a french company, ASTRIANE in Manosque. The industrialization is at the moment hold on because of financial difficulties of this company. Research of a new company is on progress.

Challenges

- Development of laser technology to decontaminate complex surfaces and metals
- Development of matter collection for complex surfaces