

## "Method and apparatus for inductively coupled plasma treatment" and its improvement for sequential treatment

### Description

The present invention relates to plasma treatment of hollow substrate surfaces having a large aspect ratio (flat boxes, small diameter tubes ...). These types of substrates are very common in medical environment or in packaging application in the food or the pharmaceutical industry. Conventional methods of plasma treatment are not adapted to object with a large aspect ratio. Difficulty to ignite the plasma, thermal damages to the substrate surfaces, limited gas dissociation, difficulty to control the plasma, non uniformity of the treatment, are all important drawbacks of existing methods.

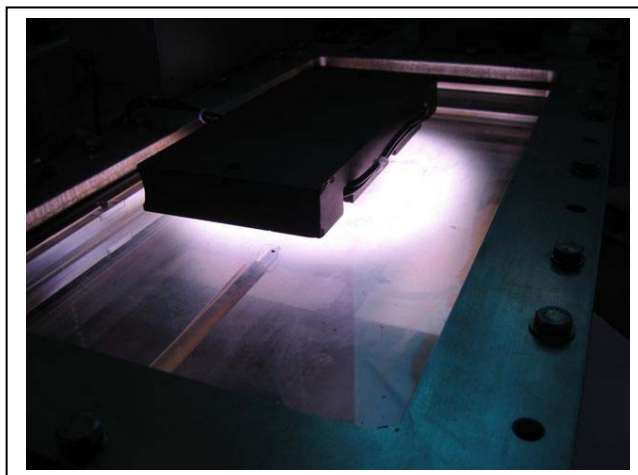
The proposed solution consists in a method and an apparatus allowing uniform plasma treatment of substrate with a large aspect ratio with high efficiency and flexibility. The invention also allows independent and selective treatment of the outside and inside of the substrate. In an improvement patent, the technology is further improved by the use of a plurality of plasma sources placed along the parts of the substrate. With such a configuration, the plasma source motion (velocity, direction, frequency, intensity) can be regulated in order to achieve uniformity of plasma treatment. The improved apparatus can ensure constant plasma density and constant precursor concentration along the whole substrate.

### Innovative aspects and main advantages

- Uniform plasma treatment for hollow substrate with a large aspect ratio
- Constant plasma density and precursor concentration
- Propagation of magnetic field not perturbed
- Plasma sources can be inductive or capacitive
- Plasma sources can be driven independently
- Plasma and gas flow can be pulsed
- Plasma source can be composed of an array of small ionisation sources alternatively powered

### Areas of application

- Antifouling or biocompatible coatings deposition inside and outside of treated substrate
- Combined cleaning/sterilization/deposition operations for medical material
- Barrier coatings and sterilization treatments for packaging applications (food, pharma ...)



### Stages of development

Patent Priority date 18.02.00  
Patent granted US-6649223  
Patent Pending JP CA EP

Industrial Prototype

### Scientific contact

Dr. François Rossi  
Joint Research Centre, IHCP  
European Commission - I-21020 Ispra - Italy  
Tel: (+39)0332/785443  
Email address: francois.rossi@jrc.it

### Licensing contact

Intellectual Property and Scientific Collaboration Unit  
JRC - European Commission  
B-1049 Brussels, Belgium  
Email: JRC-TechTransfer@ec.europa.eu  
Reference: file n°2632