

# PLASMA PROCESSING UPDATE

Issue 74

January 2016

## MESSAGE FROM DIRECTOR

With the wishes of Happy & Prosperous New Year to all readers, I enthusiastically share about recent **Technology Transfer Meet** organized by FCIPT, where few Indian industries have shown keen interest to absorb plasma technologies, for commercial application. In addition to this Institute for Plasma Research hosted **10th Asia Plasma and Fusion Association Conference (APFA) 2015**. The national and international fusion researchers shared their experiences on this occasion. I feel



extremely delighted to visualize Nuclear fusion as the future energy source for the society.

**Prof. Dhiraj Bora**  
Director, IPR

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## EDITOR'S NOTE



**Dr. S. Mukherjee**  
Head, FCIPT Division

The January 2016 issue of Plasma Processing Update covers some interesting plasma applications such as Pesticide Removal and Eco-friendly Textile processing. A novel approach for Plasma Nitriding has also been discussed here. This issue gives a glimpse of recent Tech -Transfer Meet, where a wide spectrum of plasma technologies were demonstrated to the industries for know-how transfer. Upcoming one day seminar on "Thermal Plasma Applications for Indian Industries" at FCIPT is announced in brief.

For more details, please visit us on

[www.plasmaindia.com](http://www.plasmaindia.com)



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## Pesticide removal by atmospheric plasmas

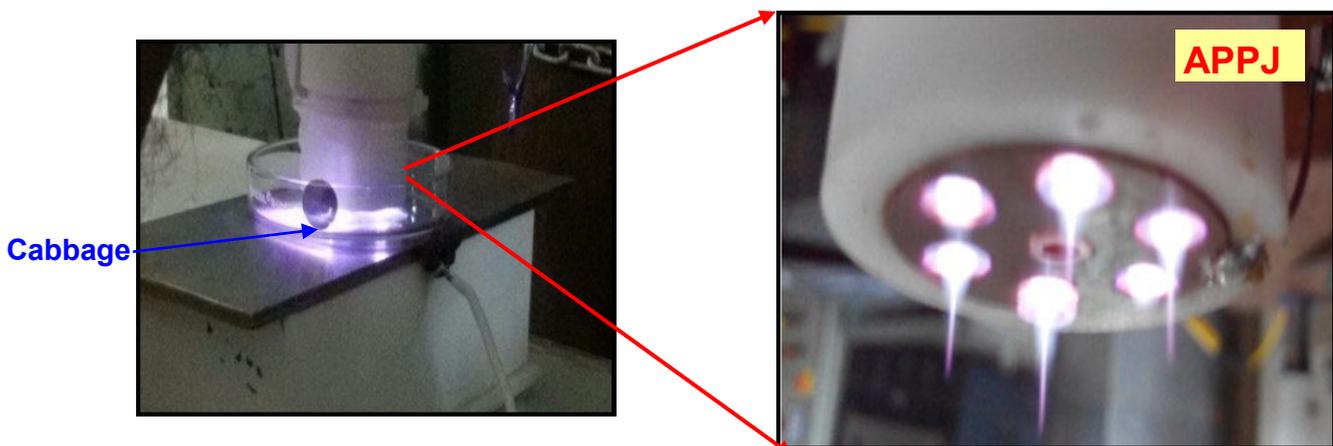
Agriculture is the life line of India as the food we eat comes through it. With ever increasing demand of vegetables and crops farmers are in pressure to raise their productivity. In order to meet the productions they are using pesticides at an alarming rate to prevent vegetables from pests. The amounts of pesticides they use are higher than the acceptable range thus increasing the concentration of harmful pesticides in the food chain.

These days, non-thermal plasmas found their applications in variety of bio-medical and agricultural

field, one such device has been developed at FCIPT, which is called APPJ (Atmospheric pressure plasma jet). APPJ works on the principle of di-electric barrier discharge. This type of plasma can be produced at atmospheric pressure and thus can be used for variety of applications. APPJ has been found to be a reliable and safe source of decreasing the concentration of pesticides over vegetables and crops. This only degrades the concentration of pesticides and does not affect the bulk properties of vegetables.

- APPJ source can be used to degrade pesticides.
- Dichlorvos concentration goes down by 3 times at 9 min treatment
- APPJ can be made in large arrays thus treating large number of vegetables.
- APPJ can be used in the **household for pesticide removal.**
- APPJ technology is **ready for transfer** to industry .
- For *details pls visit* [www.plasmaindia.com](http://www.plasmaindia.com)

### *Dichlorvos removal in Cabbage by Multiple Plasma Jet*





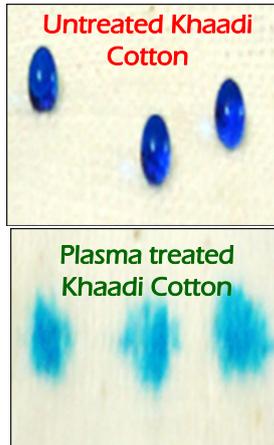
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## Eco-Friendly Pre-Treatment of Textiles

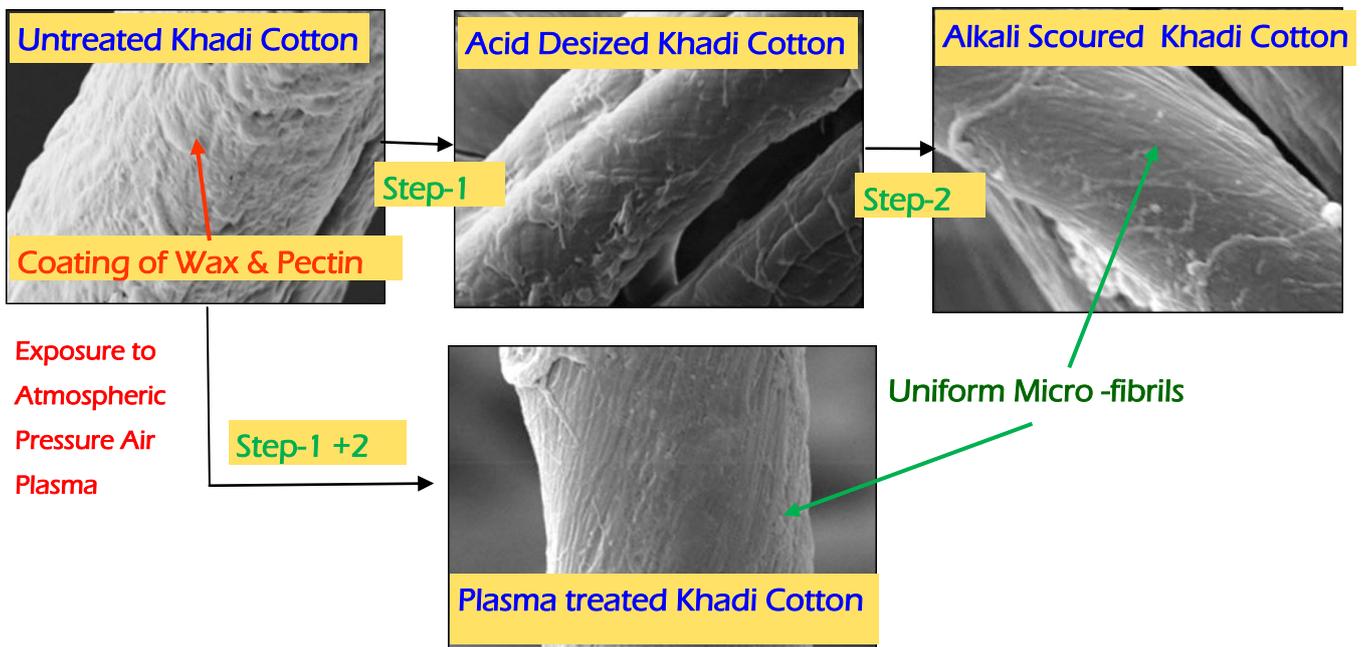
Presently, Textile industry consumes on an average 150 litres of water and 90 M Joules of energy for processing of 1 Kg of Fabric. The waste water effluent contain dyes, pigments, acid, alkali salt and other chemical that cause environmental pollution. There is a need to develop and adopt environment friendly green technologies for Textile Processing. Atmospheric Pressure Plasmas is a dry technique which may be used for surface modification of-

Textile prior to dyeing and finishing process. FCIPT has developed an atmospheric pressure air plasma process which can be used for de-sizing and scouring of cotton fabric in a single step.

De-sizing is done for removal of size material. The fabric is washed with acid followed by thorough cleaning with distilled water and drying. Scouring is done after desizing process, for removal of wax and pectin. In this case, the fabric is boiled in alkaline solution for an hour and washing and drying is done afterwards. The **atmospheric pressure air plasma** exposure for **3 minutes** gives similar result on the Khaadi Cotton fabric as obtained by wet-chemical processing.



### Scanning Electron Microscopy (SEM) Analysis

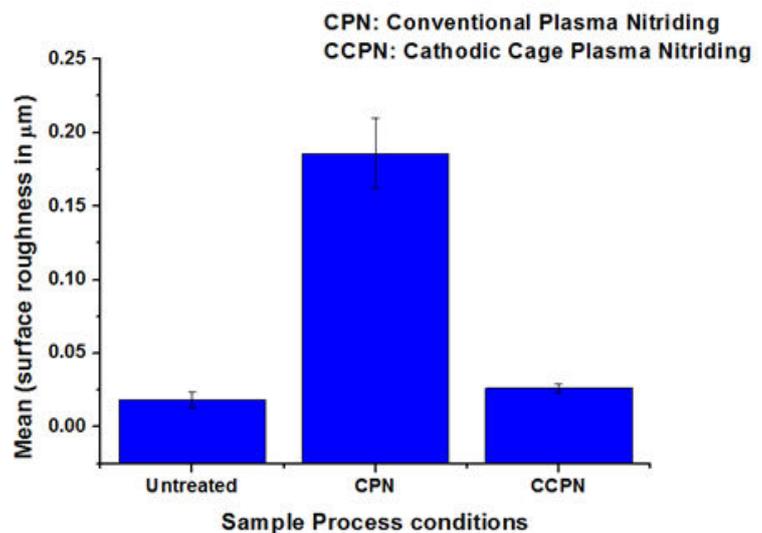




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## Cathodic Cage Plasma Nitriding – Hard Surface with Better Surface Finish 😊

Plasma Nitriding is the widely used technique to enhance the surface properties of Steel such as surface hardness, fatigue strength, wear resistance and corrosion resistance. FCIPT, IPR serves many industrial sectors by providing a job-shop facility of Plasma Nitriding. Conventional plasma nitriding process has some drawbacks as the components to be plasma nitrided are subjected to a high cathodic negative potential. This causes **edging effect**, components get damaged sometimes due to arcing, and it is also difficult to maintain uniform temperature in a large chamber. In order to overcome these disadvantages a novel process is developed at FCIPT, IPR which is called as **Cathodic Cage Plasma Nitriding (CCPN)**. In this novel nitriding process, the entire workload is surrounded by a large metal screen, on which a high voltage cathodic potential is applied. The sample holder plate and the components to be treated are insulated from the cathodic screen and the anodic chamber walls.



The cage is responsible to provide the active species for the nitriding.

At FCIPT, IPR we have conducted several experimental trials to study the performance of CCPN process on low carbon steel EN24. Samples were treated under both conventional plasma nitriding and CCPN condition at 500°C for 12 hours in the hydrogen and nitrogen gas environment and analysed for surface hardness, hardness profile, X-ray diffraction pattern and surface roughness. Results indicate that surface hardness is lower in the case of CCPN process but hardness profile shows higher case depth compared to conventional plasma nitriding process. CCPN samples does not show much increase in surface roughness and so results in better surface finish !!

## PLASMA TECHNOLOGIES - AVAILABLE FOR INDUSTRIES

FCIPT organized a “**Tech-Transfer Meet**” on **December 11, 2015** at Institute for Plasma Research with an objective to interact with the industries who are interested in making **commercial use of plasma based greed technologies**. These are low cost indigenously developed plasma technologies which may be useful to various industrial sectors like **Automobiles, Metal, Polymers, Medical Devices & Machinery manufacturing**. FCIPT would be doing about **Five Tech-Transfer** to interested industries on **Non-Exclusive Basis**. These technologies are open for industries, contact us to know more.

Invitation for Expression of Interest in leading Newspapers on November 22, 2015



### Institute for Plasma Research

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EXPRESSION OF INTEREST (Eoi)

This expression of interest is being invited by IPR for technology transfer (On **NON-EXCLUSIVE BASIS**) of the following technologies:

|     |                   |  |
|-----|-------------------|--|
| (1) | 2015/APP/PJ/TT/01 | : Atmospheric Pressure Plasma Jet for Various Applications.                  |
| (2) | 2015/PN/SHM/TT/02 | : Surface Hardening of metals using Plasma Nitriding Process.                |
| (3) | 2015/PE/BRB/TT/02 | : Process for surface modification using plasma for rubber to brass Bonding. |
| (4) | 2015/ION/IS/TT/01 | : Low Energy Broad Beam Ion Source.  |
| (5) | 2015/PD/EP/TT/01  | : Enthalpy Probe Diagnostics for Measuring hot gas parameters.               |
| (6) | 2015/PD/LP/TT/01  | : Langmuir Probe for Plasma Diagnostics                                      |

Interested parties may download the details and application form from the website : [www.ipr.res.in](http://www.ipr.res.in) or [www.plasmaindia.com](http://www.plasmaindia.com). They are requested to send their application with relevant documents on or before **3rd Dec 2015** to the address mentioned in the application form along with the registration fee. Soft copy of above documents may be emailed to [iprpt@ipr.res.in](mailto:iprpt@ipr.res.in).

**Director, IPR reserves the rights to accept or reject any applications partly or wholly.**

Glimpse of Tech-Transfer Meet on December 11, 2015



### UPCOMING - ONE DAY WORKSHOP MARCH 23, 2016

**HURRY UP!**  
Limited Seats  
Available

FCIPT shall be organizing a one day workshop on “**Thermal plasma applications for Indian industries**” in March 2016. We invite industries to participate in free workshop.

**Who Should Attend:** Industries associated with Waste-Management, Nano-technology, Automobiles, Cutting & Welding Tools, Power Generation etc.

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