



**Near Atmospheric Pressure Plasma Enhanced
Chemical Vapor Deposition for Surface Modification
of Selected Materials**

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Abstract

Plasma technology is playing an increasingly important role in industrial processes. Especially the recent developments in cold plasma technology are an interesting mechanism for cost affective processing of materials and surfaces. A non-thermal near atmospheric pressure "cold" plasma system was developed with guidance obtained with mathematical simulations and computer-aided designs (CAD). The developed system has been examined with optical emission spectroscopy and exited nitrogen, with OH and NO radicals had identified as the active plasma species.

In a second part of the work, the chemical and physical changes occurred on the material surfaces and possible applications were investigated using contact angle measurements, FTIR, UV-VIS and Tensile measurements. FTIR analysis for rubber, cotton and nylon shows evidence of material surfaces being modified with nitrogen and oxygen involved functional groups by air plasma treatment. Modifications to the surface structures in this nature are highly effective in enhancing surface properties. This is especially relevant for the value added natural rubber industry.

Water contact angle measurements of Aluminium have noted that the water contact angle has been dropped significantly as it exposed to the glow plasma; fallen below 9.5° from starting over 80° with 5 minutes of exposure. Contact angle in Perspex also drop till 25° starting around 55° , with in same period of exposure. After the treatment, Aluminium reverts back to its original wettability very faster than Perspex due to its high reactivity.

As practical applications, dye absorbance of fabric materials of cotton, polyester, nylon improves its absorbance respectively by 115%, 65% and 36.8% with 5 minutes of exposure time. Further, adhesion properties of Aluminium, Polyester, Nylon, PVC, Perspex and copper had increased in between 300%- 100%. In addition, plasma treatment ensures the removal of almost all the organic contaminations on glass surface.

Furthermore, this new plasma system is potentially convenient for hospitals and food sterilization processes. Since no wet chemistry is in use for these green processes, possible harmful environmental impacts are almost zero.

Keywords: Air Plasma, surface modification, fabric, rubber, metal