Applications of Plasma Science and Technology

Elegant and Efficient Industrial Technologies From of Plasma

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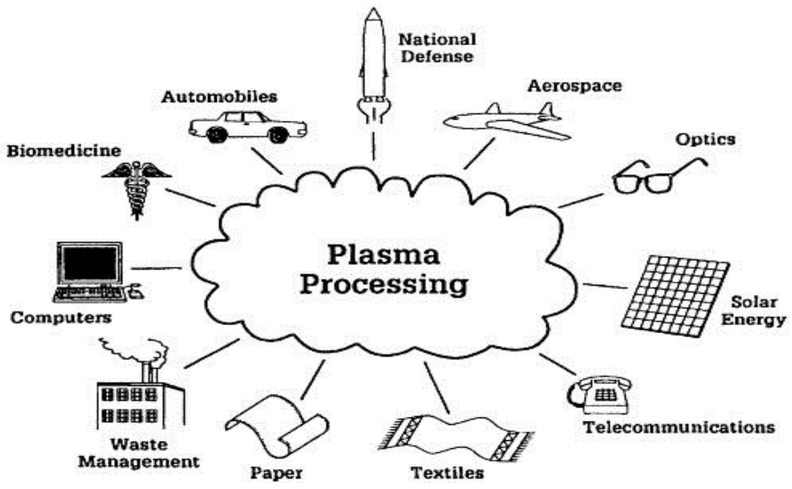
Chemical, mechanical , metallurgical, electronics, electrical processes **- in short everything that related with Industrial technology-** using Plasma are ever expanding fields of applications and hold scope for tremendous innovations for the future to revolutionize human life and well being.

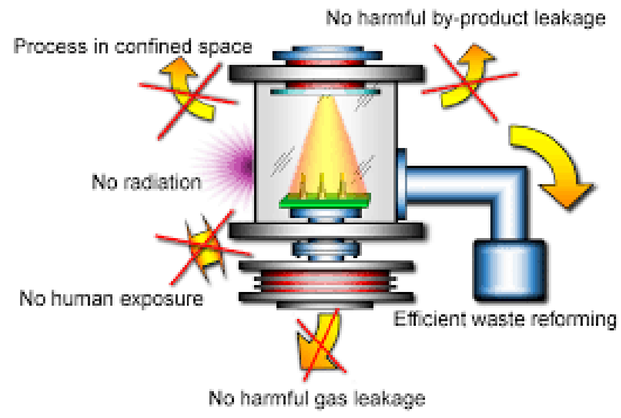


Industrial applications of plasma fundamentally emerge from its **three basic transforming capacities**

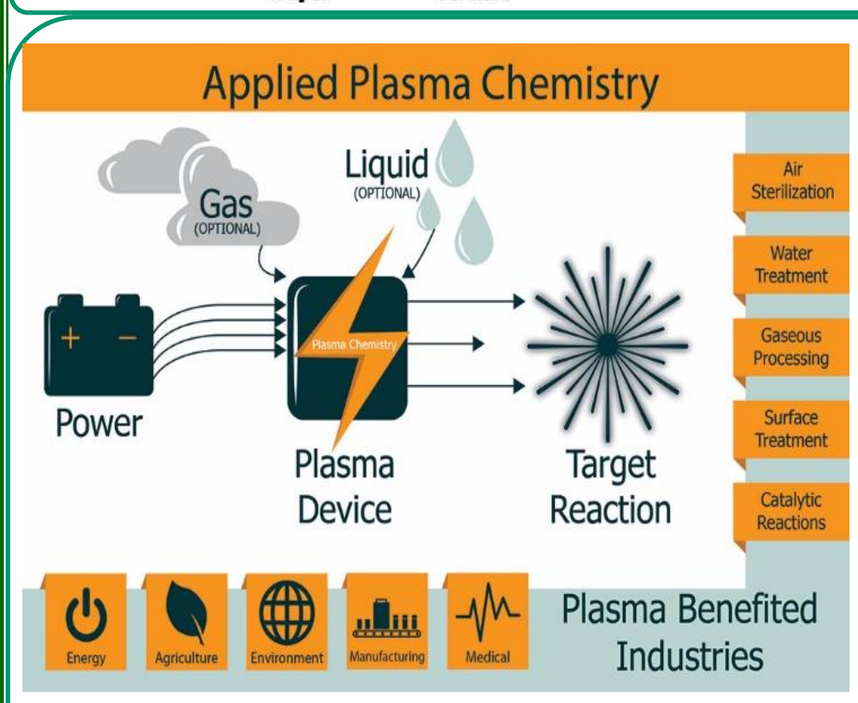
Transformation of **Particles**:– Plasma Chemistry for surface modification , etching , deposition , special gases and powder formation and environmental applications:- in changing the changing the chemical composition of the object.

Transformation of **Momentum**:- Beams of plasma , as lasers , thrusters , propulsion and acceleration effects.

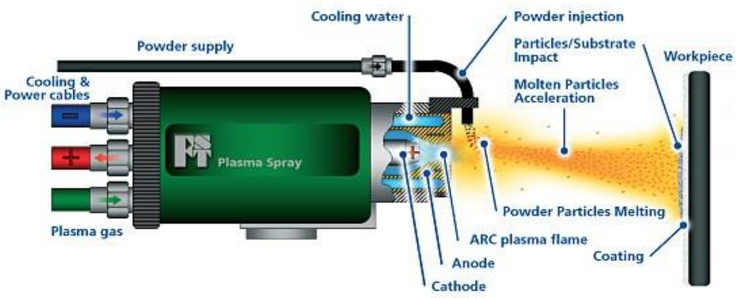
Transformation of **Energy** :- Light as lamps, displays and heat



Advantages over conventional technologies

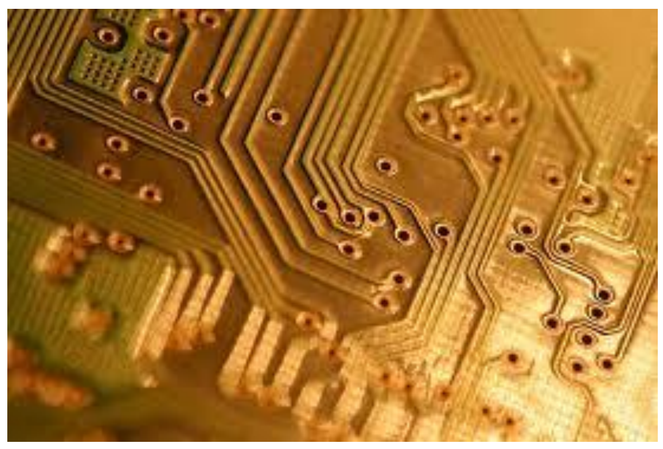


High quality **tenacious coatings** can be achieved by **plasma spraying** where a combination of very high heat energy from inert gas plasma and high velocity plasma particles of the required element . Coating as thick as micrometres to many millimetres could be achieved with high deposition rate and quality compared to traditional process

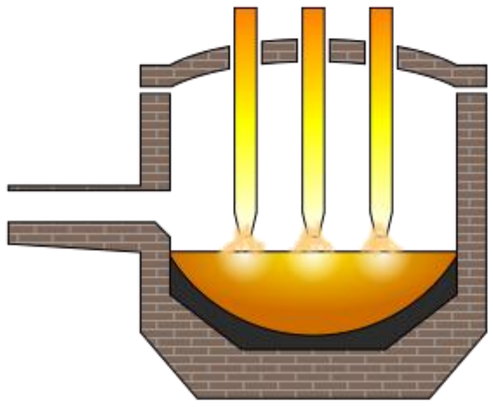


Plasma-enhanced chemical vapour deposition (PECVD) has the versatile and flexible capacity to create highly uniform, excellent purity and adhesion thin layers of various types of materials onto substrates. This has high end use in manufacturing sophisticated optics. Diamond like carbon coatings can extend tool life enormously corrosion free insulation films in microelectronics and solar panels are some other applications.

Plasma etching of materials is an advanced technique applicable on variety of material like dielectrics, semiconductors and metals. Semiconductor doping is achieved by ion implantation by similar techniques to **manufacture ICs**

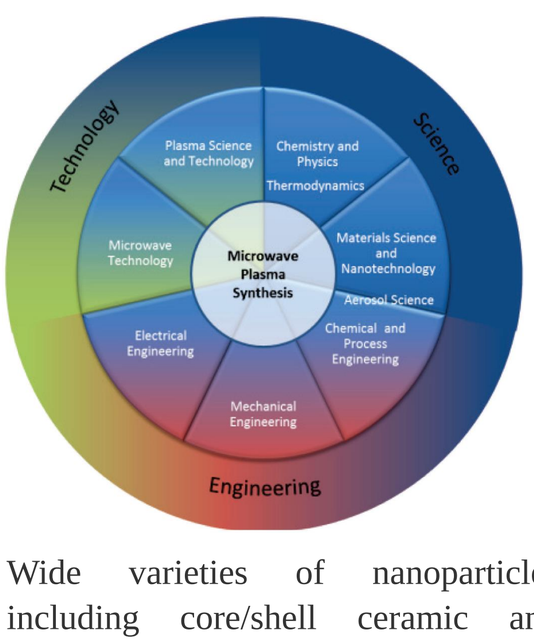


Surface hardening of metals by a heat process called **Nitriding** results in case hardened components like gears , crankshafts , valve parts, forging dies ,knives , firearm parts etc. . Plasma Nitriding technique is a very effective way compared to the toxic and cumbersome chemical process for the same.

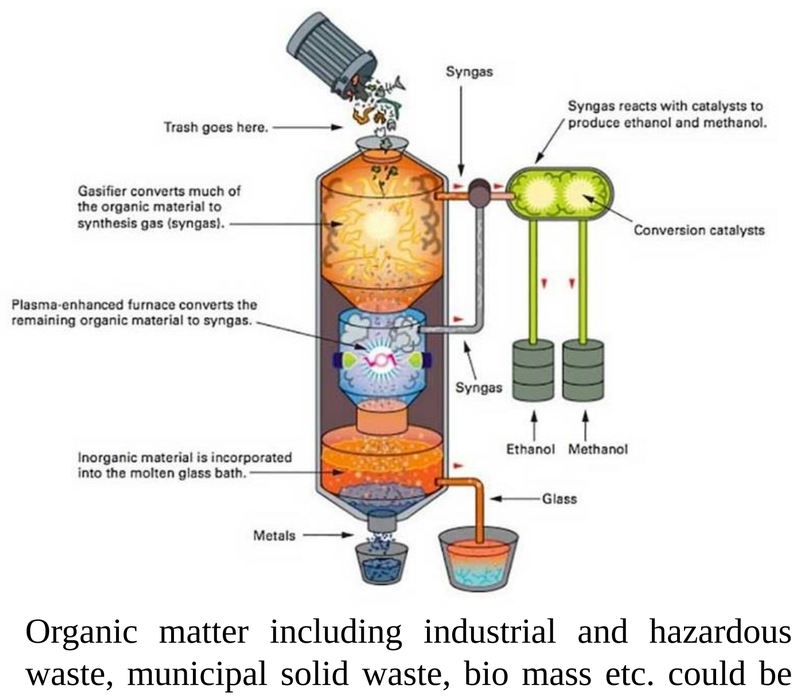


Thermal dissociation of ores by Plasa has been used in **metallurgy** since 1950 and is an efficient process . The powdered ores are either fed into the plasma jet or mixed with conducting materials to form consumable electrodes of the system. The reverse reactions are prevented by the sharp "quenching' of the gaseous dissociation products at the outlet.

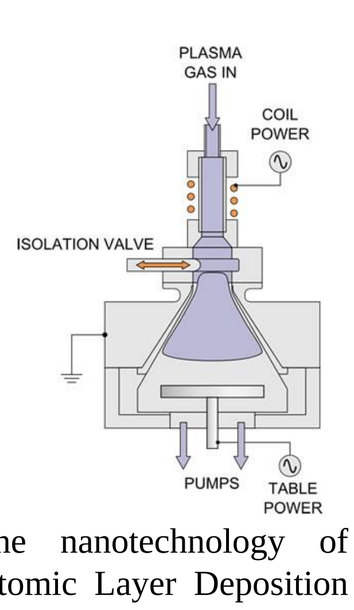
Plasma torches are versatile heavy duty equipment which could be used for variety of very high temperature applications . System could be fed with different process gases including air, oxygen, nitrogen, argon etc. to achieve custom made chemical composition environment to specific applications achieving energy tens of times higher than conventional combustion system.



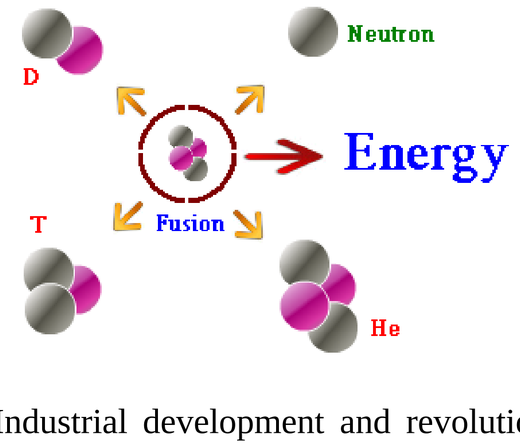
Wide varieties of nanoparticles including core/shell ceramic and organic shell nanoparticles, tubes and structures , composites could be **synthesized** using microwave plasma



Organic matter including industrial and hazardous waste, municipal solid waste, bio mass etc. could be converted in to gas by **plasma pyrolysis**. Recovery of oil, metal are some important offshoots of this process



The nanotechnology of Atomic Layer Deposition (ALD) forming ultra-thin films of a few nanometres in precisely controlled way.



Industrial development and revolution comes with availability of abundant clean energy that does not affect environment and health . Controlled Nuclear fusion is the best and promising option to achieve the same. option

Key words and topics for further exploration and details: Plasma-assisted combustion (PAC), Plasma Assisted Technologies (PATs), Subsurface Modification, Plasma Enhanced Physical Vapour Deposition, Plasma Enhanced Chemical Vapour Deposition, Surface Activation, Hot dip plasma enhanced aluminizing, Activation of Carbon Powders, Plasma ignition and flame control, fuel activation and reformation, plasma kinetics, plasma flow dynamics, coal, biomass, and waste into energy processing, water treatment, plasma propulsion, plasma carburising,

Illustrations owed to Internet websites and readily available on image search with related keywords

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