Plasma

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GAS

- is comprised of neutral atoms or molecules
- inside appear collisions of atoms,ions and electrons

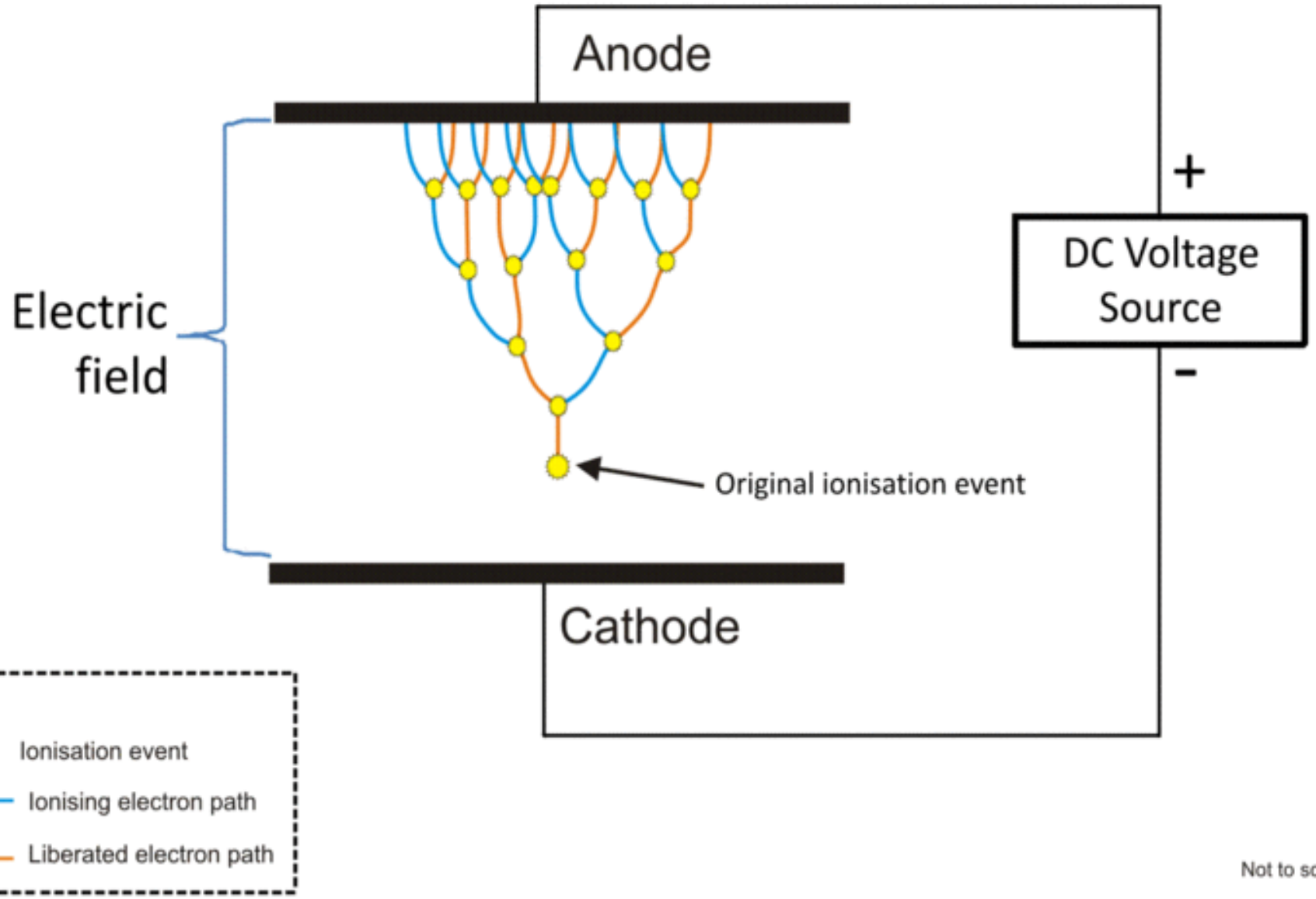
  - non-flexible collisions

  - inner energy changes
- NON-FLEXIBLE COLLISIONS CAUSE **IONIZATION, EXCITATION, DEEXCITATION AND RECOMBINATIONS** OF IONS AND ATOMS IN THE GAS

Townsend avalanche theory

- it describes the aforementioned collisions
- avalanche effect in gas subject to ionising radiation between two plate electrodes
- the original ionisation event liberates one electron, and each subsequent collision liberates a further electron, so two electrons emerge from each collision to sustain the avalanche

Visualisation of a Townsend Avalanche



Not to sca

- the result is an avalanche multiplication that permits electrical conduction through the gas
- the discharge requires a source of free electrons and a significant electric field; without both, the phenomenon does not occur

Discharges in gas

In the atmospheric or decreased pressure may apper:

1. ARC discharge – high current, lower voltage, high temperature
2. CORONA discharge – is created in a strong non-homogenous electric field
3. SPARKLE discharge – high currents through a smaller section, short lasting
4. SMOLDERING electric discharge –low current, low temperature

Plasma

- ionized gas, which is created in any discharges
- was discovered in 1923 by Lagmuir
- is comprising of ions, electrons and neutral particles and molecules
- is created by unbounding of electrons

  from the electron shell of atoms of gas

  or

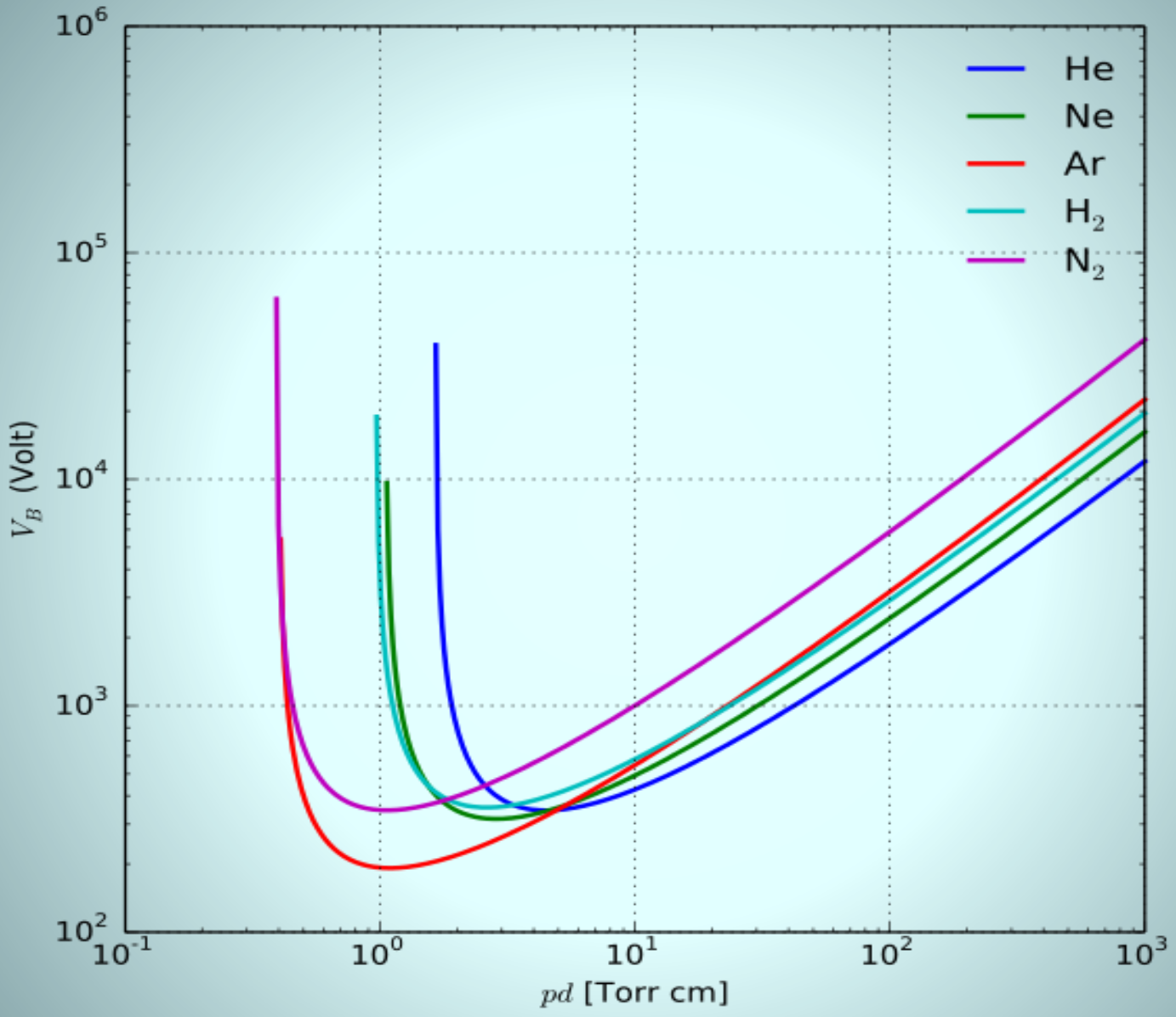
  by the tearing of molecules = ionization

Paschen´s law

- is an equation that gives the breakdown voltage U_{pr}, that is the voltage necessary to start a discharge or electric arc, between two electrodes in a gas as a function of pressure and gap length
- $U_{pr} = f.(p.d)$

f…constant

p…pressure d…distance between anode and cathode


10^6
10^5
10^4
10^3
10^2
V_B (Volt)
10^{-1}
10^0
10^1
10^2
10^3
pd [Torr cm]
He
Ne
Ar
H_2
N_2

Electrocauteries

- the first thermal effects of DC was described in the half of the 18th century by Benjamin Franklin and John Wesley
- DC current conducted through a conductor to effectively cauterize the tissue in the place of contact was used at the beginning of the 19th century

The effects of the heat on the tissues

50 – 60 °C	Cell death in approximately 1-6 minutes
60 °C	Immediate cell death
60-65 °C	Coagulation appears
65-90 °C	Denaturation of proteins
90-100 °C	Drying (desiccation) appears
Over 100 °C	Leads to vaporization

Heating of tissues by sparkle discharge

1. **Fulguration**

   -the falling sparkles carry thermal energy, which leads to the increase of intracellular cell temperature

   -this is process, in which tissues are destroyed without incision

   -these tissues coagulate superficially with a continually repeating **high-voltage** sparkles with **low current force**

2. Coagulation

-blood tissues are heated quickly during the flow of the current

-it leads to the denaturation of proteins and subsequent halting of bleeding

3. Desiccation

-intracellular liquid inside cells is heated

-it leads to the evaporation of water inside cells and to the drying of cells

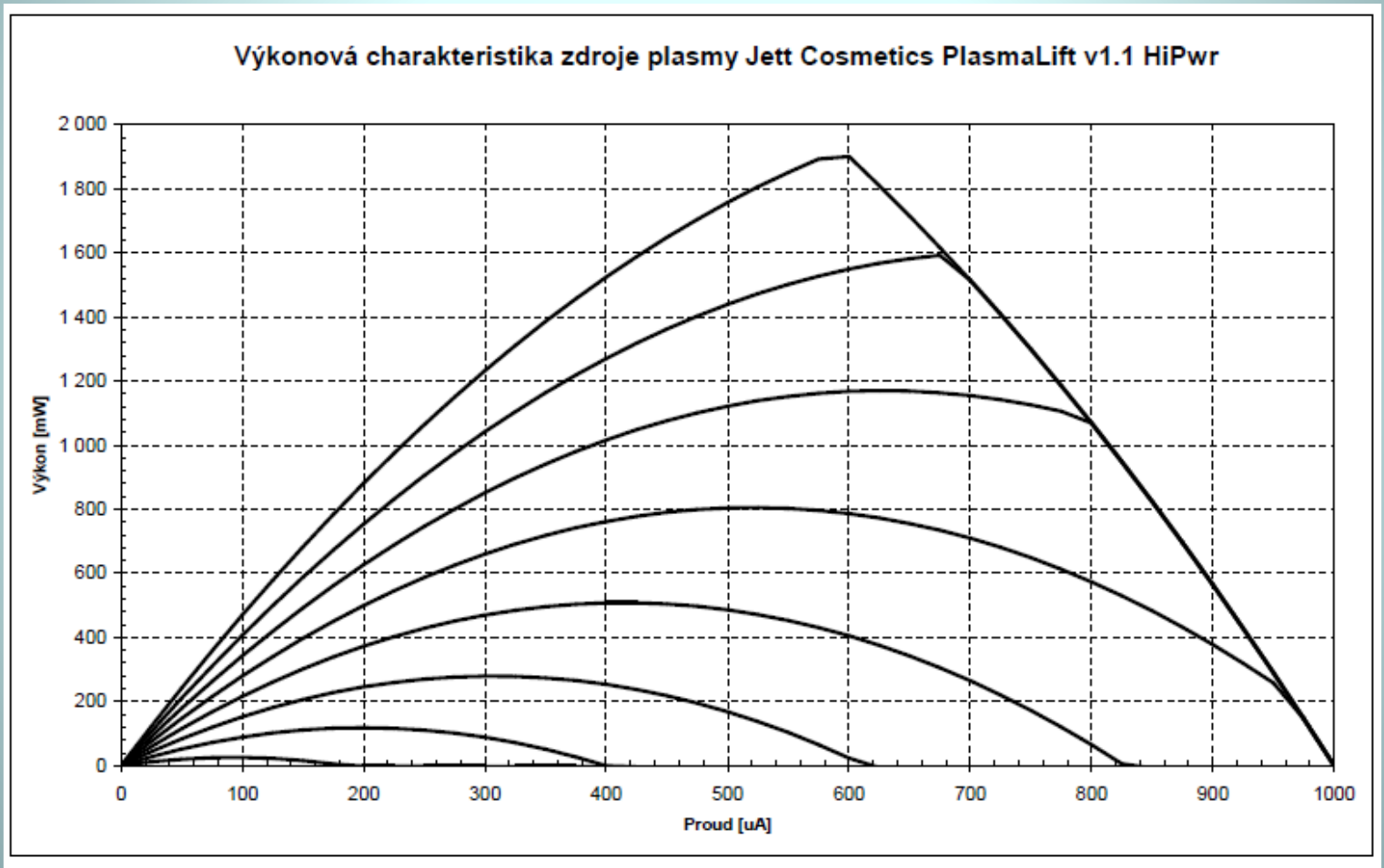
4. Vaporization

-the water from cells is vaporize due to the passage of electric current

Jett Plasma Lift Medical

- in the evaluated device is used DC fulguration
- monopolar fulguration, during which a patient is conductively connected to the device by electrode
- max voltage is 7000 V
- max current is 1 mA
- max power is 1,8 W

the best outcome is reached in the 50-60% of current



Manufacturer	Compex ltd.
Country of origin	Czech Republic
Type of device	Jett Plasma Lift Medical
Therapeutic principle of the device	Plasma discharge in combination with thermal energy, contactless application (electrode does not touch tissues)
Aim of use	Minor dermatological and surgery interventions
Working voltage	0,8 – 7 kV
Mechanical design of the device	Compact design, everything in one device, the size of a pencil electrode
Voltage of the plasma discharge generator	0,4 to 1,8 W 1 pencil electrode covers the whole range of the plasma discharge generator voltage
Detection of the grounding function	SCS Systém
Power supply	Power source – Power adapter
Size of handle	Length 24,5 cm, diameter 4,5 cm
Weight	Approx. 350 g

Thank you for your attention !