CLAIMS

1.A system for controlled drilling of a workpiece comprising:

a source (1) of electromagnetic radiation configured to transmit a measurement pulse in open air to a workpiece (12), the pulse having at least one wavelength with higher energy than a work-function of a metal layer of the workpiece (12), and giving rise to electrically charged molecules (180) deriving from interactions of air molecules with free electrons (18) that were emitted by the metal layer in the workpiece (12), the quantity of free electrons (18) emitted being dependent on the extent of exposure of the metal of the workpiece (12);

an anode (7); and characterized by:

a resettable electric charge sensor, ECS, (200), operably connected to the anode (7), the ECS (200) being configured to, subsequent to an ECS activation, accumulate electric charge derivative of charged molecules received at the anode (7);

a control unit (40), operably connected to the ECS (200), and configured to:

a) activate the ECS (200) in accordance with, at least, a time of initiation of a measurement pulse;

b) receive, from the ECS (200), at least one value indicative of a quantity of at least part of charged molecules received at the anode (7) since ECS activation,

c) determine, from the at least one value, a second value indicative of a quantity of charged molecules received at the anode (7) sinc ECS activation that were derivative of emitted electrons responsive to a measurement pulse;

wherein said at least one control unit (40) is further configured to perform a least one of:

compare at least part of said second value pr at least one combination of at least part of said second value to at least one threshold, or calculate an envelope of at least part of said second value or of at least part of said at least one combination, said at least one control unit being further configured to perform at least one of:

identifying at least one of: exposure or disappearance of said at least one metal layer partly based on outcome of said compare to said at least one threshold,

identifying at least one of: exposure or disappearance of said at least one metal layer partly based on said calculated envelope, control drilling at least partly based on outcome of said compare to said at least one threshold, or control drilling at least partly based on said calculated envelope.

2. The system of claim 1, wherein at least one value indicative of charge that has been accumulated since activation.

3. The system of claim 2, wherein the at least one value is indicative of a voltage.

4. The system of claim 1, wherein the ECS (200) is further configured to be activated according to a first molecule delay adjustment, and wherein the control unit (40) is configured to receive the at least one value according to, at least, a time of cessation of the measurement pulse, and a second molecule delay adjustment.

5. The system of claim 4, wherein the control unit (40) is configured to calculate at least one of the molecule delay adjustments according to a distance between the anode (7) and the workpiece (12).

6. The system of claim 4, wherein the control unit (40) is configured to calculate at least one of the molecule delay adjustments according to a mass of a tracked molecule type.

7. The system of claim 4, wherein the control unit (40) is configured to calculate at least one of the molecule delay adjustments according to an electric field potential of the anode (7).

8. The system of claim 4, wherein the control unit (40) is configured to calculate at least one of the molecule delay adjustments according to a temperature of open air.

9. The system of claim 1, wherein the control unit (40) is configured to periodically receive the at least one value, thereby giving rise to a signal, and wherein the control unit (40) is configured to determine the second value according to the signal.

10. The system of claim 1, wherein the control unit (40) is configured to perform a method comprising:

activating the ECS (200);

waiting for a switching noise assessment time;

receiving, from the ECS (200), prior to a calculated arrival time of charged molecules resulting from interactions with free electrons (18), a value indicative of accumulated charge, thereby giving rise to an estimation of switching noise; and

using the estimation of switching noise in the determination of the second value, thereby giving rise to a switching noise-compensated second value indicative of a quantity of charged molecules received at the anode (7).

11. The system of claim 1, wherein the control unit (40) is configured to perform a method comprising:

receiving, from the ECS (200), a preliminary value indicative of accumulated charge in a time interval calculated to be free of charged molecules resulting from interactions with free electrons (18);

waiting for a leakage accumulation delay period;

receiving, from the ECS (200), a subsequent value indicative of accumulated charge - subsequent to the leakage accumulation delay period - in a time interval calculated to be free of charged molecules resulting from interactions with free electrons (18);

calculating an estimated leakage voltage per leakage accumulation delay period according to the difference between the preliminary value and subsequent value; and

using the estimated leakage voltage per leakage accumulation delay period in the determination of the second value, thereby giving rise to a leakage-compensated second value indicative of a quantity of charged molecules received at the anode (7).

12. The system of claim 1, wherein the radiation source is configured with pulse energy such that a calculated emerging workpiece potential due to electrons emitted from a metal layer - according to trace capacitance, the pulse energy, and a number of required pulses - is not greater than 10% of the anode voltage (9).

13. The system of claim 12, wherein the ECS (200) is configured with sensitivity not greater than 1% of a calculated charge of electrons emitted from a metal layer according to, at least, metal composition and the pulse energy of the radiation source.

14. The system of claim 1, wherein the control unit (40) is configured to control the voltage of the anode (7) according to, at least, one or more of: number of holes to be drilled in a trace, hole diameter, capacitance of a trace, measurement radiation intensity, and measurement radiation pulse duration.

15. A control unit-implemented based method for controlling drilling of a workpiece (12), the method **characterized by** the steps of:

activating a resettable electric charge sensor, ECS, (200) operably connected to an anode (7) in accordance with, at least, a time of initiation of a measurement pulse;

receiving, from the ECS (200), at least one value indicative of a quantity of at least part of charged molecules received at the anode (7) since ECS activation;

determining, from the at least one value, a second value indicative of a quantity of charged molecules received at the anode (7) since ECS activation that were derivative of emitted electrons responsive to a measurement pulse from a source of electromagnetic radiation configured to transmit a measurement pulse in open air to a workpiece (12), the pulse having at least one wavelength with higher energy than a work-function of a metal layer of the workpiece (12), and giving rise to electrically charged molecules (180) deriving from free electrons (18) that were emitted by the metal layer in the workpiece (12), the quantity of free electrons (18) emitted being dependent on the extent of exposure of the metal of the workpiece (12); and

performing at least one of:
compare at least part of said second value or at least one combination of at least part of said second value to at least one threshold, or calculate an envelope of at least part of said second value or of at least part of said at least one combination, said at least one control unit being further configured to perform at least one of:

identify at least one of: exposure or disappearance of said at least one metal layer at least partly based on outcome of said compare to said at least one threshold,

identify at least one of: exposure or disappearance of said at least one metal layer at least partly based on said calculated envelope,

control drilling at least partly based on outcome of said compare to said at least one threshold, or

control drilling at least partly based on said calculated envelope.