

Supplementary files

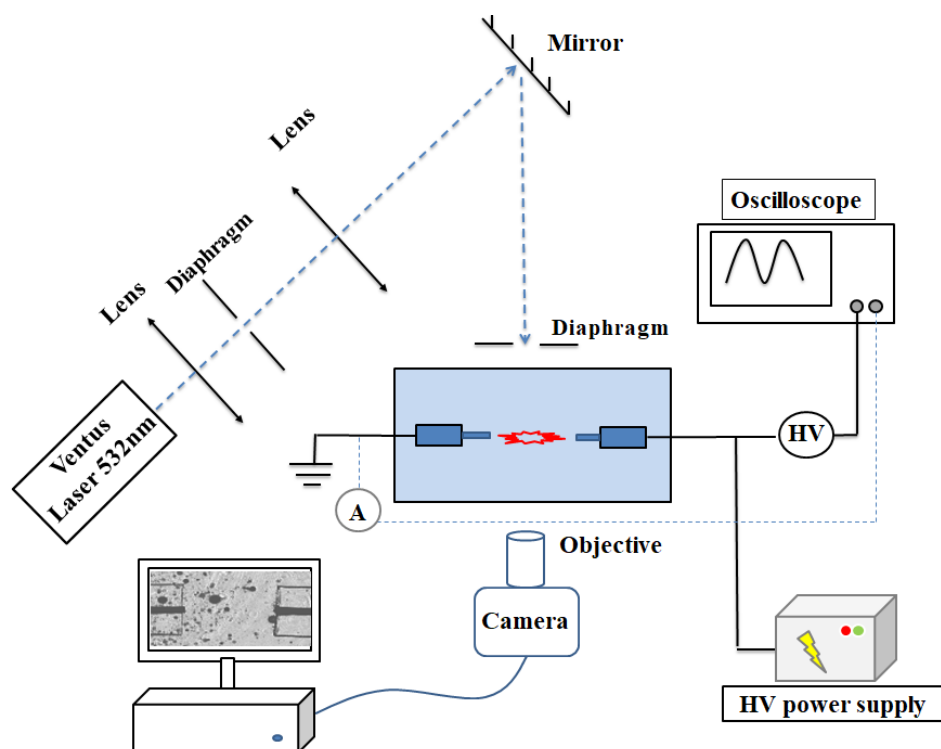
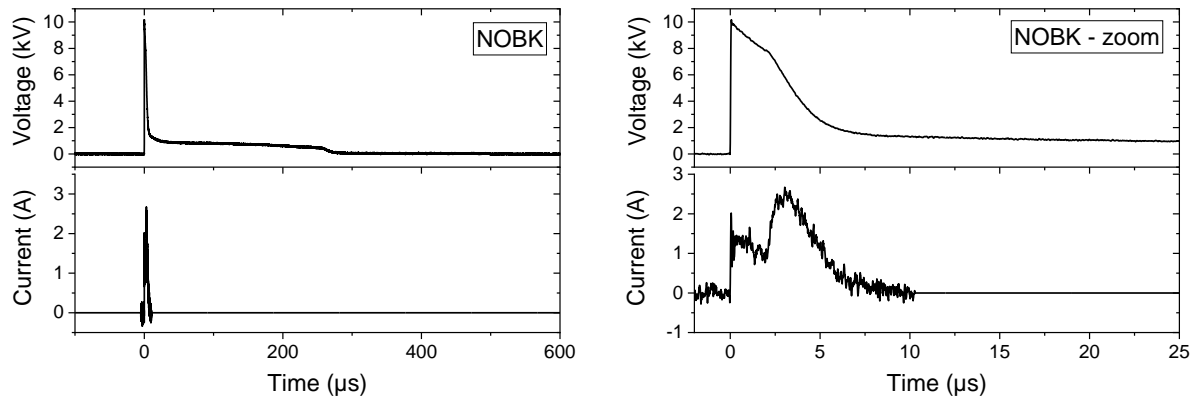
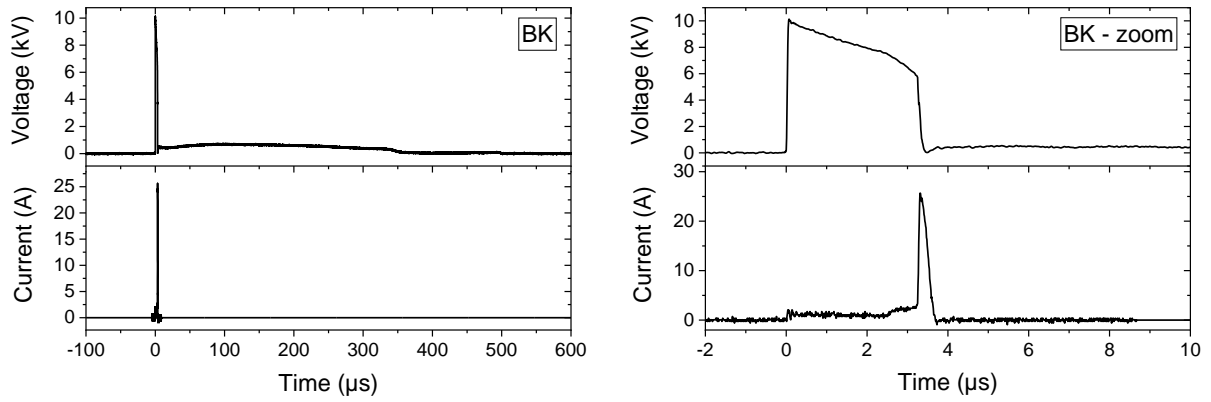


Figure S1. Schematic diagram of the optical diagnostics in Cr(VI) – the camera is a high-speed (Photron SAS) model for time-resolved shadowgraphy measurements (exposure time of $0.37\ \mu\text{s}$; frame rate of 372 kfps) and Andor istar 734 model for fast imaging (exposure time of 100 ns). The laser is off during imaging.



(a)



(b)

Figure S2. Voltage and current signals for (a) case NOBK (a zoom on the right), (b) case BK (a zoom on the right) of a pin-to-pin discharge obtained in Cr(VI) solution (47 mg/L, $\sigma=4$ mS/cm, pH=2.4) for 11 kV, $V = 100$ mL, $\Delta t = 500$ μs , gap = 2 mm, electrodes length = 0 ± 10 μm , $f = 50$ Hz. The signals have been processed (Savitzky-Golay filter and cut off detection) and the resulting uncertainties are considered in energy calculation.

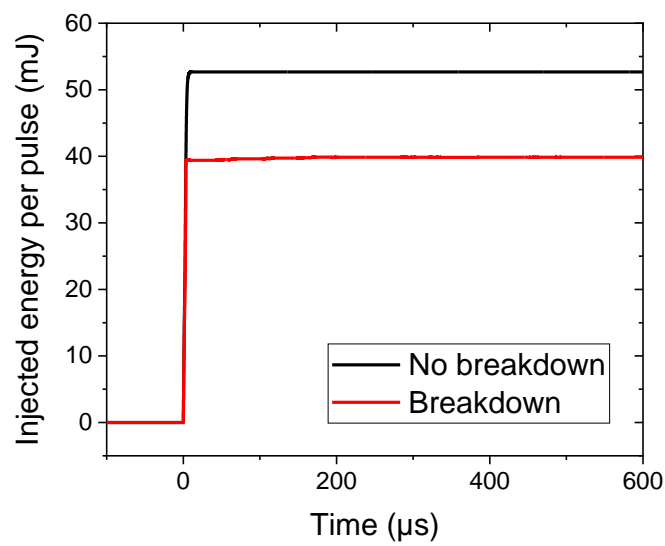


Figure S3. Energy per pulse for BK and NOBK discharges for pin-to-pin discharges in Cr(VI) solution (47 mg/L, $\sigma=4$ mS/cm, pH=2.3), $V = 100$ mL, $U=9$ kV, $\Delta t = 500$ μs , gap = 2 mm, electrodes length = 0 ± 10 μm , $f = 50$ Hz.

Power supply	Geometry	Inter-electrode distance	Voltage	Current	Volume of reactor	Initial concentration	pH of solution	Time of process	Reduction efficiency	Energy Yield $G_{Cr(VI)}/g/kJ$	References
Plasma discharge above the liquid											
DC	Pin-to-plate with gas supply	~3-5 mm	1.3 kV	40 mA	20 mL	40 mg/L	2	4 min	100%	$0.64 \times 10^{-4} *$	{Ke, 2011 #411}
DC	Pin-to-plate with gas supply	2 mm	1 kV	40 mA	25 mL	40 mg/L	2	3 min	100%	$1.4 \times 10^{-4} *$	{DU, 2017 #624}
Plasma discharge in liquid											
DC	Pin-to-plate	-	0.6 kV	120 mA	150 mL	31.2 mg/L	2	18 min	96%	$6 \times 10^{-5} *$	{Jiang, 2015 #559}
DC	Pin-to-plate	-	0.6 kV	936 mA	-	100 mg/L mix with phenol	-	30 min	93.35%	3.4×10^{-4}	{Harianti, 2017 #615}
DC	Pin-to-plate	-	0.5 kV	100 mA	150 mL	50 mg/L	2	5 min	97%	$4.9 \times 10^{-4} *$	{Wang, 2008 #427}
Pulse DC	Pin-to-pin	0.5 mm	9 kV	Peak 40 A	100 mL	47 mg/L	2.4	90 min	100 %	4.7×10^{-4}	This work

Table S1 - Comparison of reduction efficiency and energy yield for Cr(VI) reduction by plasma liquid interaction processes. * these values have been calculating using Equation 2 and data of the references