State-of-the-art plasma source with ultra-fast arc quenching circuit for pulsed magnetron sputtering applications

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Arcing on sputter targets and negatively biased substrates is known as one of the most challenging issues in physical vapor deposition of thin films [1]. This is particularly relevant when reactive gases, large target surfaces or high power pulsed sputtering processes are considered. To address these issues, the technological advances in the field of power electronics during the last decades resulted in manufacturing of more complex systems for plasma generation that can manage arcing events with minimal damage to target and substrate.

In this work, the conception of a (bipolar) high-power impulse magnetron sputtering (HiPIMS plasma source is considered [2] including an ultra-fast arcing quenching circuit allowing detection *and* suppression of the arcs in less than 1.2 µs. In this regard, two arc handling strategies have been considered: (i) the arc can be detected by a fast current sensor, which gives an arc signal once the discharge current grows above a defined level and (ii) the arc is detected by a sudden increase of the voltage across the high-power transistor above a certain threshold [3].

In order to evaluate the efficiency of the arc handling process, a 3-inch titanium target was reactively sputtered in an Ar/O_2 atmosphere by HiPIMS using average power, cathode voltage and discharge peak current up to 500 W, 1000 V and 150A, respectively. Further investigations are shortly expected including other cathode materials.

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