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High deposition rate magnetron sputtering

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Among all PVD technologies, magnetron sputtering stands out with high quality and versatility of the produced coatings. Recent advancements in high-power impulse magnetron sputtering improved sputtering process and coating properties even further, making it highly desirable for many applications. However, most common disadvantage of the magnetron sputtering — low coating deposition rate — in many areas inhibits technology transition to mass-production due to low cost efficiency. Main cause of slow coating deposition is low discharge power density — conventional magnetron sputtering operates at power density in the range 1 — 50 W/cm^2, and, while HIPIMS peak power density can reach several kW/cm^2, average power rarely exceeds 50 W/cm^2 resulting in low deposition rate of 1 — 2 µ/h per cathode in 1-D rotation.
High deposition rate magnetrons [1] can withstand average power densities much more than HIPIMS in continuous mode due to special design and effective cooling system, which leads to significant deposition rate increase up to 20 µm/h per cathode for metallic coatings and 10 µm/h per cathode in 1-D rotation for composite and complex composition coatings, making magnetron sputtering technology feasible for mass-production in almost any area. Moreover, equalization of sputtering rates for different materials is observed at power densities exceeding 50 W/cm^2 in multi-component targets. Thus, multi-element coating composition can be easily controlled via target design.

[1] Mitin, E. Sharipov, A.Mitin. Surface Engineering, 22/1, 5-10 (2006)

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