

Developed in the PWI

HYBRID LASER-ARC DEPOSITION OF DIAMOND AND DIAMOND-LIKE COATINGS

SCHEMES OF THE PROCESS

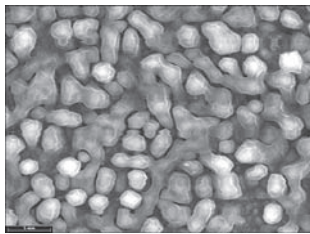


Intercoupling of plasma jet with laser radiation: CO₂-laser (2 kW), plasmatron MP-03 (2 kW)

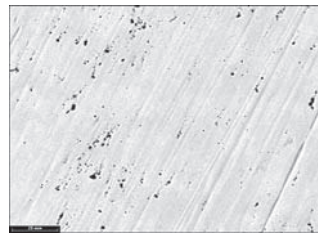
Coaxial interaction of plasma jet with laser radiation: CO₂-laser (2 kW), plasmatron ILDP-01 (2kW)

Parameters of the processes

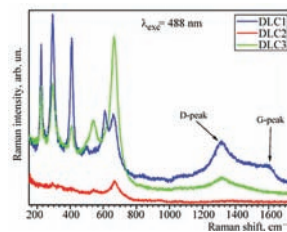
Types of coatings	Duration of treatment, min	Treatment distance, mm	Working gas (composition, consumption, l/min)	Material of base	Temperature of base, °C
Diamond	5–15	40–75	95H ₂ + CH ₄ 0.8–2.3	Mo, Si	600–950
Diamond-like	7–15	50–180	95H ₂ + 5CH ₄ 0.6–1.4	Steel 45, titanium alloy	100–250



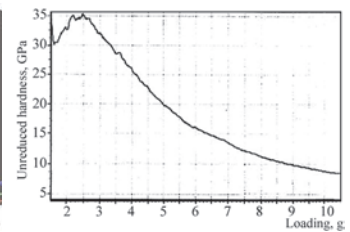
Diamond coating based on molybdenum



Diamond-like coating on steel



Raman spectroscopy of diamond-like coatings



Hardness of diamond-like coatings on steel 45 at T < 250 °C, Δ_{coat} = 0.5–7 μm

PROPERTIES OF DIAMOND-LIKE COATINGS

Coating thickness, μm — 0.3–3

Hardness/ GPa:

- on steel surface — 12–35 (hardness of base makes 2.0–2.6)
- on surface of titanium alloy — 15–30

Deposition rate, μm/h — 2–25

RESULTS

- physical-mathematical model of plasma jet, which is generated by integrated laser-arc plasmatron, was developed;
- an integrated laser-arc plasmatron ILDP-01 of up to 5 kW power for coating deposition was developed;
- a process of laser-plasma coating deposition under conditions of intercoupling and coaxial interaction of plasma jet with laser beam was investigated;
- conditions of formation of diamond and diamond-like coatings were investigated;
- structure of diamond coatings on the bases from Mo and Si and structure and properties of diamond-like coatings on the bases from steel 45 and titanium alloy were investigated.

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