*35th EPS Conference on Plasma Phys. Hersonissos, 9 - 13 June 2008 ECA Vol.**32D**, P-1.173 (2008)*

# Comparison of the low friction graphite-metal coatings prepared by thermionic vacuum arc and plasma spray methods

P. Lungu[1], A. M. Lungu[1], P. Chiru[1], O. Pompilian[1], C.Porosnicu[1], I. Voicu[1], I. Morjan[1], C. Iacob[2], D. Trusca[3], I.Trusca[3], V. Manoliu[4], C. Serghie[4], D. Buzescu[5], C. Puscasu[5], A.Tudor[6]

*[2]National Institute for Lasers, Plasma and Radiation Physics,Bucharest Romania*

*[2]Plasma Jet SRL, Bucharest, Romania*

*[3]SC COMPUTER POWER SRL, Bucharest, Romania*

*[4]National Institute for Aerospace Research "Elie Carafoli", Bucharest, Romania*

*[5]National Research and Development Institute for Gas Turbines, Bucharest, Romania*

*[6"]Politehnica" University - CESIT, Bucharest, Romania*

Environmentally friendly low friction coatings to be used as overlays for automobile journal bearings are highly desirable nowadays. Two methods, the original method called thermionic vacuum arc (TVA) developed at the National Institute for Lasers, Plasma and Radiation and plasma spray developed at the Plasma Jet SRL were evaluated and compared in order to obtain graphite-metal layers to act as solid lubricants. The TVA method uses two separate electron beams emitted by two externally heated cathodes accelerated by two high anodic voltages. The electron beams evaporate the graphite and the metal used as anodes. Applying high voltages (1-5kV) between cathodes and respective anodes, bright plasmas in pure carbon and metal atoms are ignited simultaneously. The plasmas were controlled independently by the electron beams emitted by the heated cathodes. The co-deposited metals were Ag, Cu, Al and Sn. The plasma spray method uses a plasma gun working at atmospheric pressure feed with graphite and metallic powders with 20 μm mean grain size. In a set of experiments carbon nanopowder prepared by laser pyrolysis was added to the spraying powder. The carbon-metal films prepared by TVA method were characterized as a metallic complex of nano-crystals (5 nm average diameter) surrounded by carbon amorphous structures with a strong graphitization tendency. By plasma spray method were produced films having rough morphology and micrometric sized crystals. The coefficients of friction of the coatings, measured using a CSM ball-on-disc tribometer, in dry conditions were in the range of 0.15-0.25 three to five times lower than the uncoated substrates. The wear rate of the bearings was drastically reduced up to ten times.