Modification of aluminium-titan and nickel-titan thin layers by plasma flow action

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The main focus of this study is to investigate morphological changes occurring on aluminum-titanium (Al-Ti) and nickel-titanium (Ni-Ti) thin films when treated with a compressed plasma flow which was formed in the magnetoplasma accelerator and comparation of these changes with those obtained during the treatment with laser pulses. Al-Ti and Ni-Ti multilayer systems have been created by alternate deposition of nanometer-thick layers (of Al or Ni on Ti) on a single silicon substrate, by sputter deposition method. The thickness of each individual layer is roughly 20 nm. The total number of layers varying from 10 to 20 per target. We have compared two different types of interactions - one being an interaction between Er:glass and Nd:YAG laser beam and target, while the second was an interaction between the plasma flow and target.

Relatively high values of plasma parameters of the compressed plasma flows (electron density in the order of 10^23 m^-3, and plasma temperature of 2 eV) together with large plasma flow velocity (of 100 km/s in hydrogen plasmas) and discharge duration (of up to 50 μs) makes them suitable and efficient for studies of surface modifications under high thermal loads. In addition, we are able to investigate the formation of specific micro- and nanostructures, the occurrence of morphological characteristics arising from the movement of the molten material pieces, and the formation of craters caused by ablation of the target.

When a target is irradiated with a laser beam, most of the absorbed energy of the laser radiation is transformed into heat, causing the formation of intermetallic compounds. Modifications are similar as to those formed by plasma flow-target interaction.

We present here a comparison of the periodic formations of previously stated modifications in these two types of interactions. Present study is of interest for investigations related with material of interest for fusion experiments.

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