Contribution ID: **82**   Type: **Oral Presentations**

Carbon-Silicon- Titanium - Aluminum nanostructures doped with nitrogen: synthesis and characterization

Using Thermionic Vacuum Arc technology were created nanostructured thin films using four material: graphite, titanium, silicon, and aluminum, with the inclusion of nitrogen, on the Si substrate. TDS analysis reveal the presence of nitrogen in all cases. The Raman spectra show that the nitrogen treatment of the films leads to the formation of nitrides for each compound. The infrared absorption spectra are dominated by the formation of C-N bonds exactly as in Raman spectra. EDX and Elemental composition show that the values of atomic percentage depending of the substrate deposition temperature. EDX and STEM mapping was carried out to evaluate sample composition. Based on XPS depth profile it turns out that . the peaks of the three materials Si, Al and Ti are well defined whereas O concentration is much lower, due to the high working temperature. Based on nanoidentation studies, Young modulus and Hardness are measured.The values of the Hardness in the case of N-doped thin films are generally bigger compared with the values in the case of undoped films. The tribology data reveal that the values of the friction coefficient in the case of N-doped thin films are generally smaller compared with the values in the case of undoped films. Electrical conductivity on the Ti-Si-Al-C-N films shows the increase of conductivity with the increase of the nitrogen content.

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