DESCRIPTION FOR THE GENERAL PUBLIC

Modern field of material engineering moves toward fabrication of multifunctional materials in order to maximize the potential use of materials with intrinsic multifunctionality and to design and fabricate composites with active multifunctional phases. One example of a multifunctional material class may be found within the family of MAX phases. Due to intrinsically layered covalent/metallic bonded structure these phases have a remarkable combination of chemical, physical, electrical, and mechanical properties that make them fascinating and potentially useful in many industrial applications. By now, the tribo-mechanical properties of bulk MAX phases and their synthesis are relatively well studied. Nevertheless, a quite small amount of experimental data is reported for thin film MAX phases. MAX phase thin films are promising as surfaces in electrical sliding contacts, low friction surfaces, sensors, tunable damping films for microelectromechanical system or other tribological systems. Research related to MAX phases has over 20 years long story and more than 60 nanolaminates were obtained via different synthesis methods, however there is no conducted research on MAX phase deposition by use of electron beam physical vapor deposition. Most of syntheses of MAX phases thin films have been performed at substrate temperatures in the range 700 –1000 °C, limiting the use of temperature-sensitive substrates. One of the ways to reduce the deposition temperature is application of energetic ion flux during film growth. In this view, synthesis and optimization of the MAX phases by means of ion assisted EB-PVD method will allow to solve the problems of basic research related to elaboration of methods for MAX thin films formation. Therefore, MAX phase deposition via EB-PVD and optimization of the process is one of the basic scientific problems which will led to better understanding of MAX phases producing. Moreover, it is important to obtain much more useful information concerning tribologycal behavior of $Ti_{n+1}AlC_n$ thin films. Publication of the results of this scientific research will significantly improve the state of the art related to tribological and mechanical properties of MAX phases as well as expand the knowledge in the field of a chemically stable, lubricious and chameleon high temperature materials. Obtained results will significantly increase the advancement of technical, chemical and physical sciences in fields related to synthesis, exploitation and characterization of thin films based on MAX phases.