Synthesis and Characterization of CrZr–O–N Films Using Cr–Zr Segment Targets by Unbalanced Magnetron Sputtering

Dong Jun Kim, Joung Hyun La, Sung Min Kim, Sang Yul Lee*

Center for Surface Technology and Applications, Korea Aerospace University

The Cr-Zr-N films have much improved mechanical properties and very smooth surface roughness. However, in spite of their outstanding properties, the Cr-Zr-N coatings revealed their mechanical properties deteriorated severely with increasing Zr content at 500°C because of very rapid oxidation. Recently oxynitride films have been widely studied due to their excellent unique mechanical properties and oxidation resistance. In this work, CrZr-O-N films with various O contents were synthesized by unbalanced magnetron sputtering with Cr-Zr segment targets (Cr:Zr volume ratios is 1:1) and all films were prepared in a nitrogen rich mixture of N2 and O2. Characteristics such as crystalline structure, hardness and chemical composition as a function of the O content were investigated by X-ray diffraction (XRD), field emission scanning electron microscope (FE-SEM), microhardness testing system and energy dispersive spectroscopy (EDS). Results showed that the thin films had dense and compact microstructure as O content in the films increases. The microstructure of the thin films consisted of mainly crystalline Cr (Zr)N phase and Cr2O3 phase. The maximum hardness and elastic modulus of the films was measured to be approximately 33.2 GPa and 280.6 GPa from the films with low content of O elements. Detailed experimental results will be presented.

Keywords: CrZr-O-N films, Oxynitride, Crystalline structure, Hardness