MITT.ÖSTERR.MINER.GES. 151 (2005)

TWO-DIMENSIONAL, TEMPERATURE-DEPENDENT RAMAN-MAPPING OF ALUMINIUM-CHROMIUM-NITRIDE HARD COATINGS

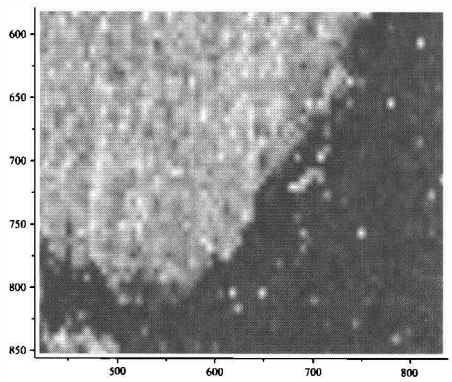
Kaindl, R.[1], Mitterer, C.[2], Franz, R.[2] & Tessadri, R.[1]

[1]Christian-Doppler Laboratory for Advanced Hard Coatings, Institute of Mineralogy and Petrography, University Innsbruck, Innrain 52, A-6020 Innsbruck, Austria

[2]Christian-Doppler Laboratory for Advanced Hard Coatings, Department of Physical Metallurgy and Materials Testing, University of Leoben, A-8700 Leoben, Austria

e-mail: reinhard.kaindl@uibk.ac.at

Aluminium-chromium-nitride $Al_xCr_{1-x}N$ hard coatings significantly increase hardness, wear resistance and oxidation resistance of metal cutting tools. We used Raman spectroscopy to investigate the structure and the phases of coatings deposited on silicon-wafers and steel by an industrial-scale arc-evaporation system (Balzers RCS). Two-dimensional spectral mappings at room temperature and for the first time up to 700°C were generated by combining a X-Y motor-driven stage with a high-temperature cell. The mappings show the distribution of coating and substrate after "ball-on-disc" tribological wear experiments, changes within coating wear debris, e.g. wear-induced grain size reduction and structural disturbance, and thermally induced re-crystallization of the coating surface.



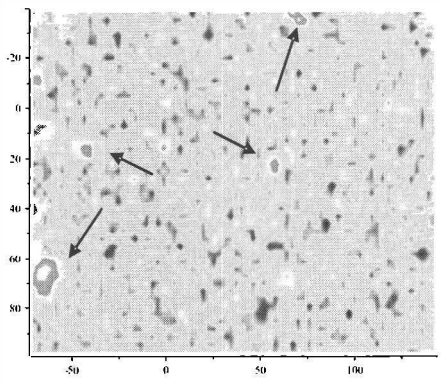


Fig. 1 (left): Raman spectral mapping at room temperature of the wear track of Al-N coating after a "ball-on-disc" tribological wear test with a corundum ball. Each pixel represents one single Raman spectrum. Light grey areas in the upper left of the image correspond with hematite from the steel substrate indicating complete removal of the coating during wear test. To the lower right the Al-N coating is still preserved. Numbers give image size in μm.

Fig. 2 (right): Raman spectral mapping recorded in the high-temperature cell at 700°C of an $Al_{70}Cr_{30}N$ coating deposited on a silicon wafer. Regions of high intensities of the characteristic longitudinal optical phonon of silicon at this temperature are drawn by white colours and indicate very thin ore even absent coating (arrows).