Phase and Stress Analysis of Porous Titania Layer with Two-dimensional XRD

Bob B. He[a], Kewei Xu[b], [a]*Bruker AXS, Madison, WI, USA.* [b]*School of Materials Sci. & Eng., Xian Jiaotong University, Xian 710049, PRC.*
E-mail: bhe@bruker-axs.com

The surface modification of titanium by micro-arc oxidation under various voltages was performed to form a porous titania layer which may improve the biocompatibility of titanium implants. The phases and residual stresses of the porous layers were measured with two-dimensional X-ray diffraction. The results show the porous layers contain anatase (TiO_2) and rutile (TiO_2). The content of rutile (TiO_2) increases with increasing voltage. At 450V, anatase peaks almost disappear and many new peaks appear in the profile, some of them are identified as polymorphous $CaTiO_3$. The residual stresses in the porous layers are compressive and increase with increasing voltage.

This presentation also introduces the recent progress in two-dimensional X-ray diffraction using the above application as an example for microstructure and residual stress analysis. The two-dimensional X-ray diffraction provides far more information than the conventional X-ray diffraction. Phase identification can be done by integration over a selected range of diffraction rings. The integrated data gives better intensity and statistics, especially for those samples with texture, large grain size, thin film or small quantity. Stress measurement using two-dimensional detector is based on a direct relationship between the stress tensor and the diffraction cone distortion.

[1] Huang P., Xu K., He B,. Han Y., *Mat. Sci. Forum,* 2005, **490-491**, 1552. [2] He B., Xu K., Wang F., Huang P., *Mat. Sci. Forum,* 2005, **490-491**, 1.

Keywords: porous materials, stress, two-dimensional XRD