AbstractID: 14200 Title: TiO2 nanotube field emitter as a new cold cathode for X-ray generation

Introduction/Purpose: Titanium dioxide (TiO_2) nanotubes (NTs) grown by anodization are proposed as a new candidate for a cold cathode X-ray source. This kind of oxide nanotube can potentially be an excellent choice to overcome the major limitations that exist in relation to carbon nanotubes (CNT). Being an oxide, TiO_2 is not affected by residual oxygen present in the tube in contrast to CNTs, which can severely degrade from exposure to oxygen. Second, since TiO_2 nanotubes are grown on a titanium (Ti) sheet as the latter oxidizes, a good electrical contact between TiO_2 nanotube film and conductive Ti substrate is guaranteed. On the other hand, poor electrical contact between CNT and deposited substrate causes heating effects. The goal of this work was to simulate the effect of the NT parameters on field TiO_2 NT emission properties. **Methods:** The field emission from two sources was considered: 1) from the top of NTs, and 2) the bottom of the NTs which serve as a thin semiconductor layer. Numerical calculations were performed to study the dependence of field emission on NT parameters for each emission mechanism. The calculations were performed in Matlab. **Results:** It is shown that the current decreased significantly with an increase of NT diameter, while it increased with the height of NTs. The rate of current increase with diameter is stronger for smaller diameter NTs. Regarding field emission from the bottom of the TiO_2 layer, this current is strongly dependent on the TiO_2 layer thickness and decreases as the latter increases. This current linearly increases with an increase of TiO_2 electron charge carrier concentration. **Conclusions:** Effect of TiO_2 NT geometrical and physical parameters on field emission can be simulated and the results can be used as a guide for design purposes.