Résumé

TiO_2 and Nb-doped TiO_2 films have been studied in the point of view of their application as transparent conductive oxides and photocatalytic material. According to the literature, there are
several reports on the Nb-doped TiO_2 films deposited by sol-gel spin-coating and dip-coating methods, however only limited numbers of studies have been reported by the chemical spray pyrolysis method.
The aim of the thesis was to grow TiO_2 and Nb doped TiO_2 thin films by chemical spray pyrolysis, and to study the morphology, structural and optical properties of the Nb-doped TiO_2
films as a function of the solution composition, Nb concentration (0-40 at%) in the spray solution, and the deposition temperature. Two different spray solutions for the deposition of Nbdoped
TiO_2 films were made, solution-A, where unstabilised $Nb(OEt)_5$ was added to TiO_2 spray solution and solution–B, were $Nb(OEt)_5$ was stabilized with acetylacetonate prior adding to the
TiO_2 spray solution. The deposition temperatures of TiO_2 and Nb-doped TiO_2 films were varied
from 260°C to 400°C and the obtained films were annealed in the temperature range of 500-700°C. The films were characterized by SEM, EDX, Raman, XRD and UV-VIS measurements.
Nb-doped TiO_2 samples deposited from solution- A (unstabilised $Nb(OEt)_5$ precursor) at 260 °C
consist of a film covered with particles. The number of particles increases, however, the thickness
of the films decreases from 245 nm to 130 nm with increasing the Nb content from 10 to 40 at%
in the spray solution. Stabilisation of $Nb(OEt)_5$ with acetylactone (solution-B), hindered the formation of particles on top of Nb-doped TiO_2 films. EDX studies show that Nb is incorporated
into Nb-doped TiO_2 layers, containing of Nb-poor film part and Nb-rich particles on the surface.
XRD results showed that the TiO_2 and Nb-doped TiO_2 films consist of anatase structure, irrespective of the deposition temperature, solution composition or Nb concentration in the solution. It showed that the film parts were consisted of anatase TiO_2, whereas the spectra of particles revealed several Raman peaks which could belong to NbxOy, TixOy, and $TiNb_2O_7$. Nbdoped
TiO_2 films with particles on top, fabricated from unstabilised $Nb(EtO)_5$ solution, could be applied as a photocatalytic material. Compact Nb-doped TiO_2 films, with less surface features, deposited from acetylacetonate stabilized $Nb(EtO)_5$ could be beneficial window layer in various
types of solar cells.