

ZnO NANOSTRUCTURES BY WET CHEMICAL DEPOSITION METHODS

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Herein we are presenting a complex study on ZnO rods obtained by electrodeposition (ED) at 80 °C and spray pyrolysis (SP) at 550 °C. Firstly we analysed influence of the different substrates on the growth mechanism of the SP and ED ZnO rods and then tried to establish the reason of different wettability behaviour and photocatalytic activity (PA) for obtained rods. Samples were studied using XPS, SEM, XRD, AFM, Raman and contact angle (CA) measurements. Photocatalytic activity of the rods was evaluated by means of photocatalytic oxidation activity of several compounds, namely, doxycycline, methyl-tert-butylether, humic acid, N,N-dimethyl p-nitrosoaniline and prednisolone.

It was revealed that formation of the SP rods highly depends on the surface roughness and the grain sizes of the substrate, whereas formation of ED rods is also affected by the conductivity of the substrate. According to the XPS study, as-deposited ED and SP ZnO rods have different chemical composition and defect structure. The relative amount of hydroxyl groups on the surface of as-deposited ED rods is four times higher compared to as-deposited SP rods. Opposite to SP rods, ED rods contain oxygen vacancy defects (Vo). Therefore, as-deposited ED rods are superhydrophilic (CA~3°) and show highest PA among studied rod samples, being three times higher compared to SP rods (removing of 75 % of doxycycline after 30 minutes). It was revealed that as-deposited ED rods are inclined to faster contamination. The amount of C=C groups on the surface of two-month-aged ED rods is six times higher compared to aged SP rods. Stored ED samples become hydrophobic (CA~120°) and PA decreases sharply while SP rods remain hydrophilic (CA~50°), being more resistive to the contamination. The annealing of the rods restore PA of SP rods and show only moderate improvement in case of ED rods. The relationship between the surface composition and morphology of ZnO rods, assessment of their surface contamination, wetting properties and photocatalytic performance will be discussed.



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